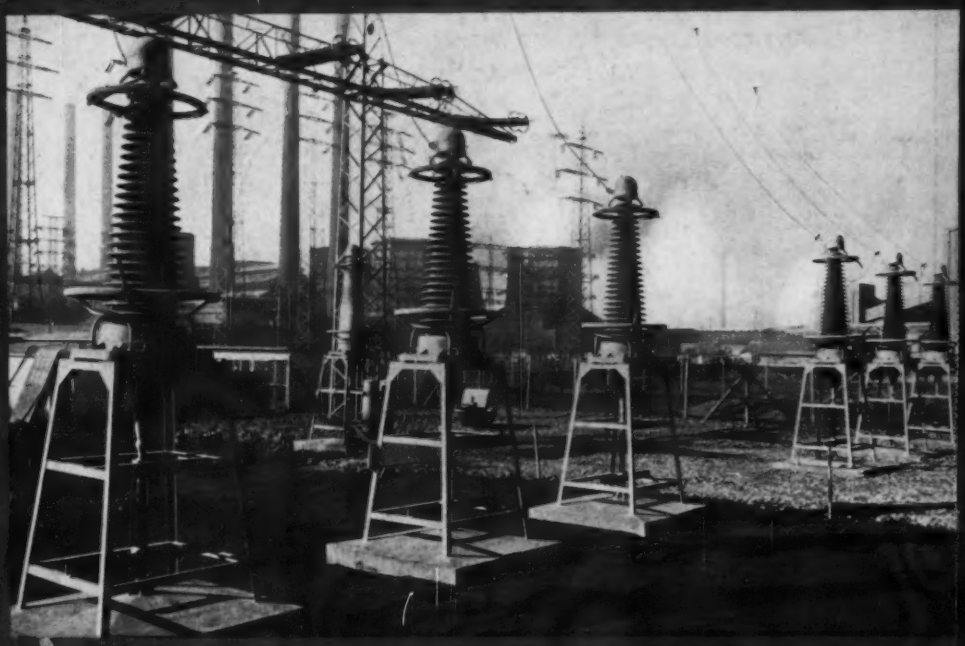
The Electrical Industry's Weekly Magazine August 15, 1960

Electrical World

Price 50 Cents

A McGraw-Hill Publication

How Germans Link Lines and Plants With 220-Kv Cable... p70



Also in this issue:

Industry packs its bags: A ten year forecast shows far horizons lure utilities' biggest customers...p99

UNIV MICROFILMS INC
EDITORIAL DEPT
313 N FIRST ST

Quick...Easy...Sure

STRIP back cable insulation...arrows on INSULINK show how far.

INSERT wire ends; **caps grip and hold cable,** both hands are free for crimping.

CRIMP with standard compression tool... guide lines on INSULINK show where.

Pre-insulated

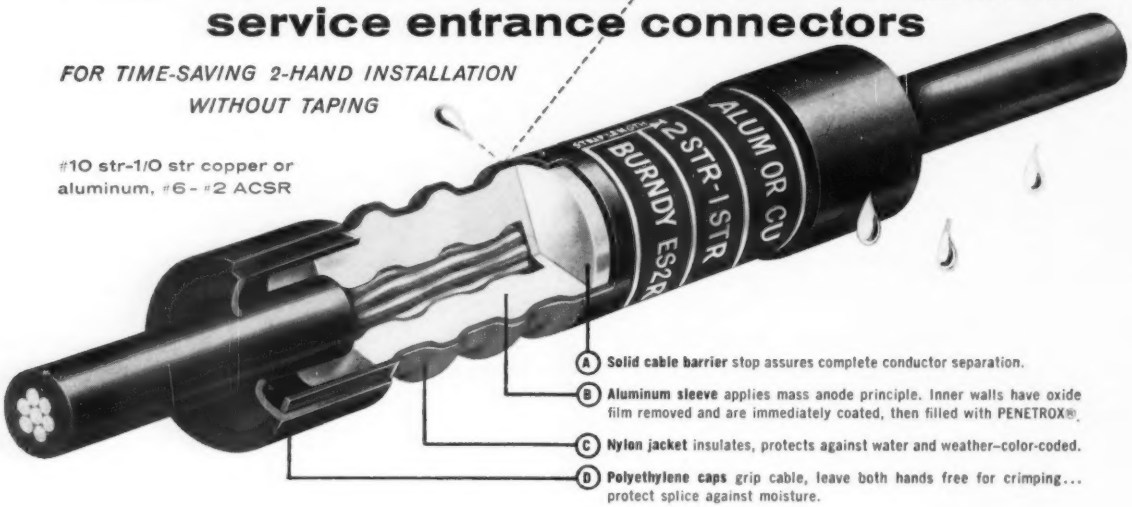
INSULINK®

Patented Other Patents Pending

service entrance connectors

FOR TIME-SAVING 2-HAND INSTALLATION WITHOUT TAPING

#10 str-1/0 str copper or aluminum, #6 - #2 ACSR



(A) **Solid cable barrier** stop assures complete conductor separation.

(B) **Aluminum sleeve** applies mass anode principle. Inner walls have oxide film removed and are immediately coated, then filled with PENETROX®.

(C) **Nylon jacket** insulates, protects against water and weather–color-coded.

(D) **Polyethylene caps** grip cable, leave both hands free for crimping... protect splice against moisture.

Connect service entrances with much less effort, in less time, **without taping.** INSULINK pre-insulated compression connectors are installed in three simple steps with the same crimping tools and dies used to install uninsulated connectors...for time-saving economy...for neat, fully protected, electrically stable connections. INSULINK connections are

QUICK: because there's no taping.

EASY: color-coded connector jacket clearly marked to show cable ranges, strip length, where to crimp. Just strip...insert...crimp; caps hold cable ends in place for simple two-hand installation.

SAFE: fully insulated to protect personnel; protected against water and weather; neat, attractive appearance.

Get the full story on **INSULINK** pre-insulated connectors from

BURNDY

59-6

Norwalk, Connect. In Europe: Antwerp, Belgium Toronto, Canada

Electrical World

Vol. 154, No. 7 AUGUST 15, 1960

Published for 86 years for those engaged in the business of generating, transmitting, distributing, or applying electrical power

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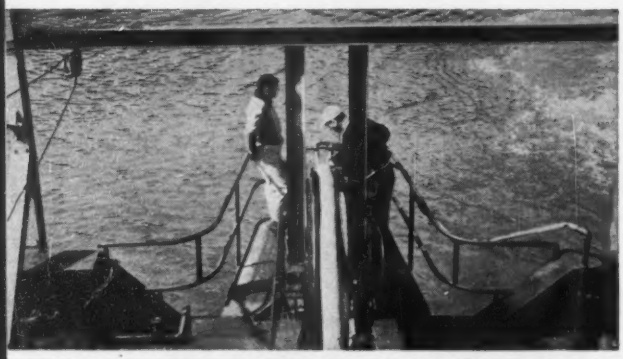
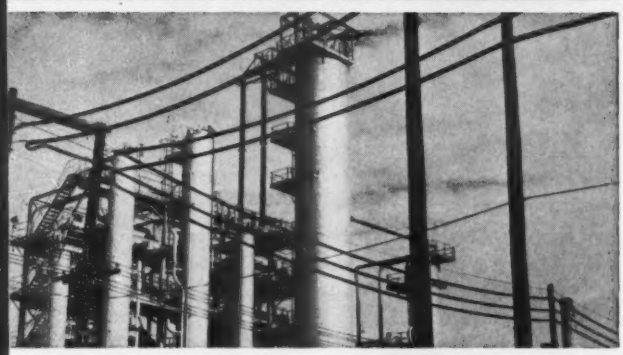
How Okonite solves your High-Voltage Distribution Problem

Reliable primary distribution is a must for efficient, economical operation. As the use of higher voltages increases, the problems of keeping primary distribution reliable increase too. But, whatever your specific need, Okonite has designed a construction that will do the job . . . like those shown here.



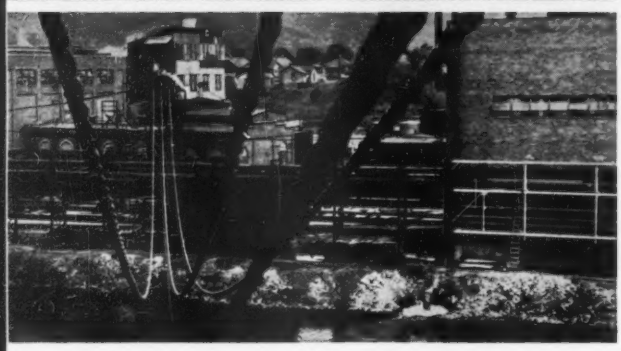
OKOLITE-INSULATED

This Okolite-insulated 25kv submarine power cable, installed by Bonneville Power Administration under Puget Sound, was 7½ miles long, weighed ¾ million lbs. It is typical of the many Okolite-insulated cables designed to solve specific high voltage power problems. Other constructions for underground, aerial, duct or interior installation are frequently protected by an Okoprene (neoprene) sheath, compounded to Okonite's own formula for high weather, temperature and abrasion resistance. Okolite oil-base insulation has demonstrated in more than 30 years of service its high dielectric strength, moisture-resistance and stability in all types of installation conditions. All Okolite-insulated cables must withstand self-imposed a-c and d-c voltage tests that are highest in the industry.



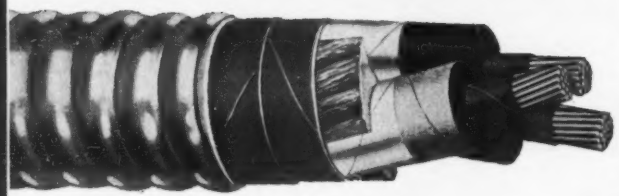
OKONEX-OKOPRENE

This Okonex-Okoprene 15kv primary distribution system was installed to save space, eliminate safety problems and provide improved voltage regulation at Magnolia Petroleum's 1500-acre refinery near Beaumont, Texas. Okonex (butyl-base) cables are highly resistant to heat, and are often specified to give additional protection in high ambient parts of the plant or to provide additional ampacity in circuits. The Okoprene sheath provides excellent protection against moisture and corrosion as in Magnolia Petroleum's refinery where there was a high moisture-saline content in the air plus chemical atmospheres at many of the processing units.



SELF-SUPPORTING CABLE

These four 7500-volt Okolite-Okoprene self-supporting aerial cables span 395 feet to distribute power to a section of a Southern paper mill. Easy to install in one simple operation, Okolite-Okoprene self-supporting aerial cable reduces clearance space requirements, is neat-appearing, often may be installed on existing buildings or supports, offers greater safety to personnel and eliminates insulator flashover due to contamination. Okonite's patented Dualay assembly can be tapped hot at any point in non-shielded types.



LOXARMOR

And on any high-voltage construction, a Loxarmor covering offers economy and flexibility in a cable system where the complete protection of a rigid conduit system is not required. Excellent mechanical protection is provided by a Loxarmor interlocking "S" tape available in galvanized steel, aluminum, bronze or copper. Loxarmor saves money in installation and initial purchase costs, makes it easy to add or re-route circuits and requires less space than conduit to handle the same number of circuits.

One of these high-voltage cable constructions will fill your requirements. Write for Bulletin EW-1117, "How to Choose Insulated Cable," to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.

***where there's electrical power... there's* OKONITE CABLE**

7080

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LETTERS

Response to Small Systems Report

▶ *We would like to share with our readers excerpts from responses to our special report on "Small Systems Engineering" carried in the May 30 issue:*

To the Editor:

I liked the report so well that I sent in and asked for (and received) nine extra copies which I distributed to my board of directors.

I did this because it would be helpful in showing them the problems we have and they could then better evaluate our operations . . .

Malta, Idaho

A forward step.

Greensburg, Ind.

I wish for more articles on small internal combustion plants . . .

Dillingham, Alaska

As an east coast small utility, we would like to see a study of some of our distribution construction problems. I noticed most of the area covered in your very fine report seemed to be in the midwest. We are different than they in that we have shorter distance circuits, more heavily loaded. Our difficulties are due to trees and load patterns. This, of course, applies only to construction. . . .

Wallingford, Conn.

Report was good but was too general. I would prefer to see only one item covered at a time and in much more specific detail.

Elk River, Minn.

. . . I know that it represents the investment of a lot of work and quite a few frustrations pulling something like this together. . .

Washington, D. C.

I had clipped the entire report for the file and the use of our supervisor . . .

McPherson, Kansas

During some years of activity in the small utility field I have become more convinced of the need for the publication of technical discussions directed particularly toward technical operating personnel in this field. Your special report on Small Systems Engineering is right down that alley. . . .

Richmond, Ind.

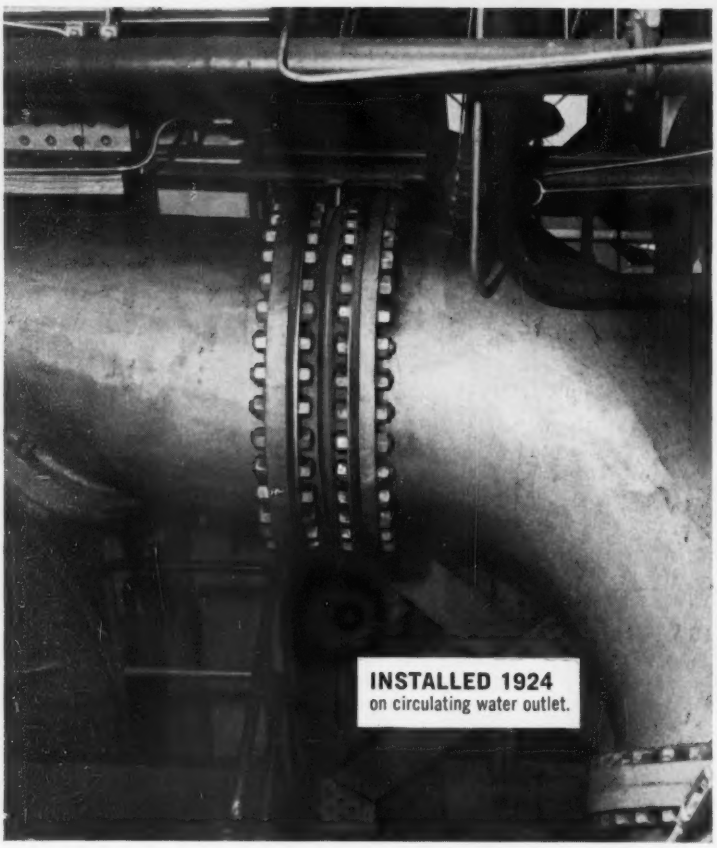
We most certainly did appreciate the section on Small Systems Engineering. . . .

Atlantic, Iowa

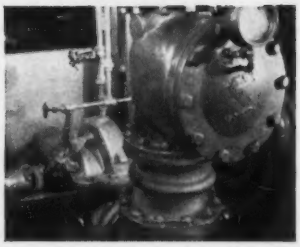
. . . I hope I live to see the day that there is greater cooperation, mutual trust, and understanding between the two (rural electric cooperatives and investor-owned power companies). Your publication could help a great deal—How about it fellas?

Enfield, N. C.

US RUBBER EXPANSION JOINTS



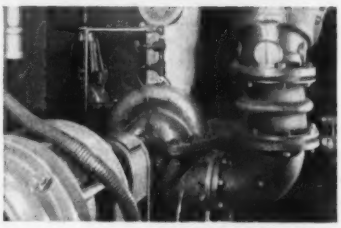
INSTALLED 1924
on circulating water outlet.



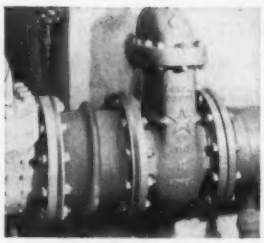
INSTALLED 1930
on discharge of harbor water pump.

INSTALLED 1936
on discharge of harbor water pump

INSTALLED 1924
on circulating water inlet.



INSTALLED 1941
on suction end of condensate pump.



INSTALLED 1941
on discharge end of booster pump to hydrogen coolers and oil coolers.

35 years ago Baltimore G. & E. first installed U. S. Rubber expansion joints —they're still on the job!

Baltimore Gas and Electric was one of the first utilities to install "U. S." Expansion Joints. These economical, flexible connections are used in pipe lines to take up the stresses due to vibration, expansion and contraction. They prevent the transmission of noise and take care of misalignment, and can be installed on both new and old piping and equipment. Every kind of industry relies on "U. S." Expansion Joints to prolong the life of equipment in pressure or vacuum pipe systems.

When you think of rubber, think of your "U. S." Distributor. He's your best on-the-spot source of technical aid, quick delivery and quality industrial rubber products.

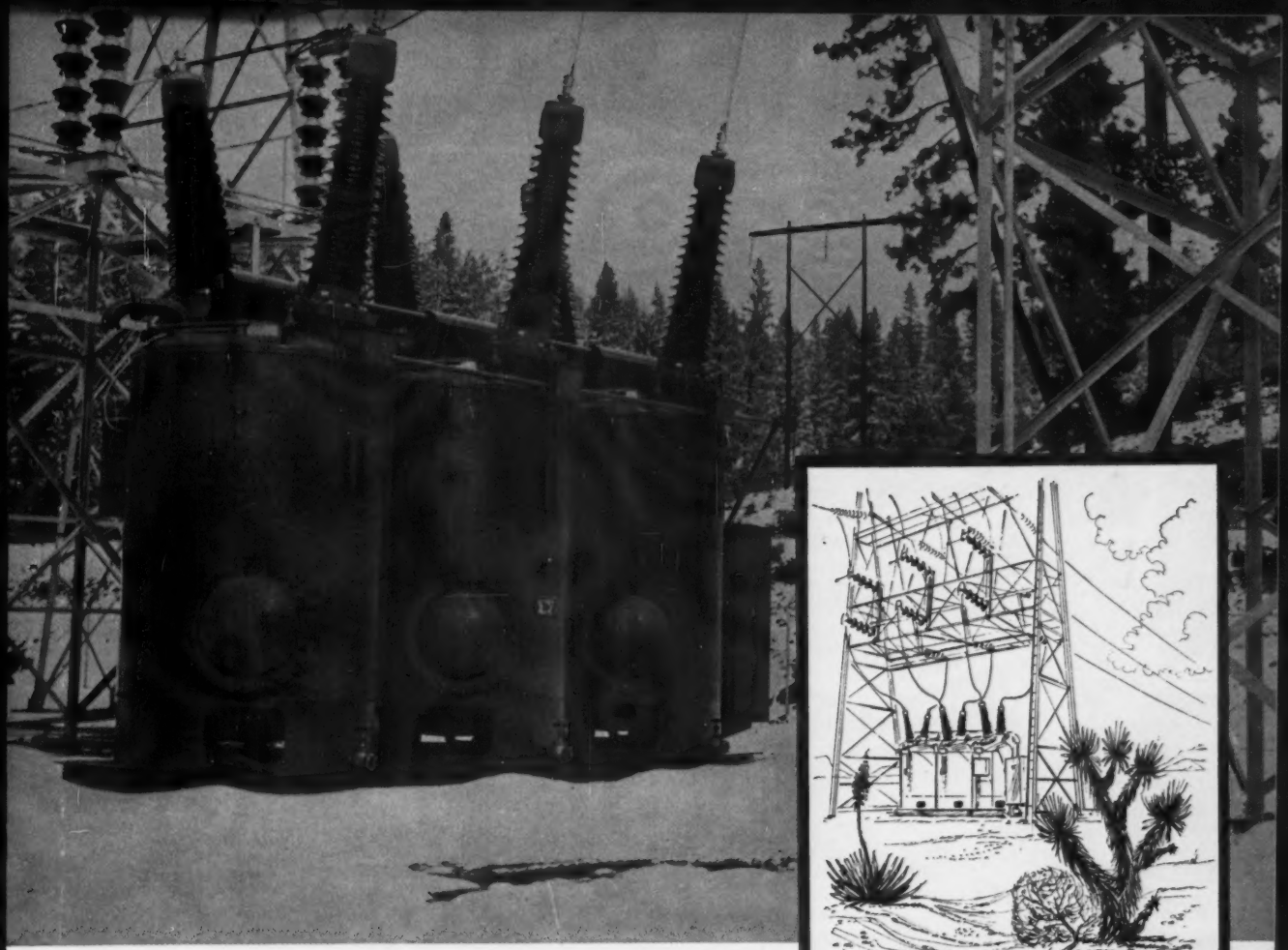
US RUBBER

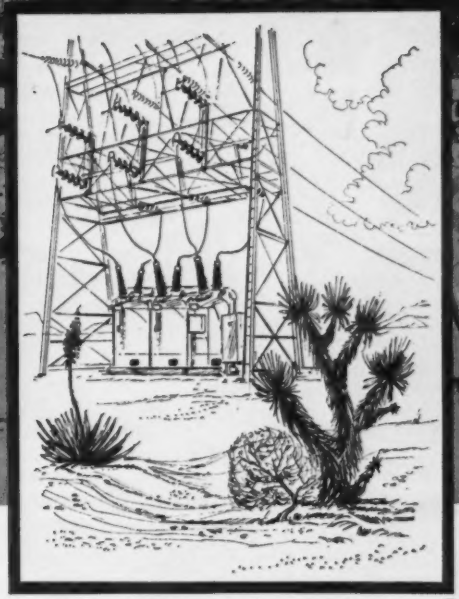
Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.





I-T-E installations stand up daily to the ravages of —

- the windswept Western deserts
- the freezing Rockies and High Sierras
- the salty Pacific coastline
- the wet forests of the great Northwest

FROM SNOW AND ICE TO SCORCHING SUN...

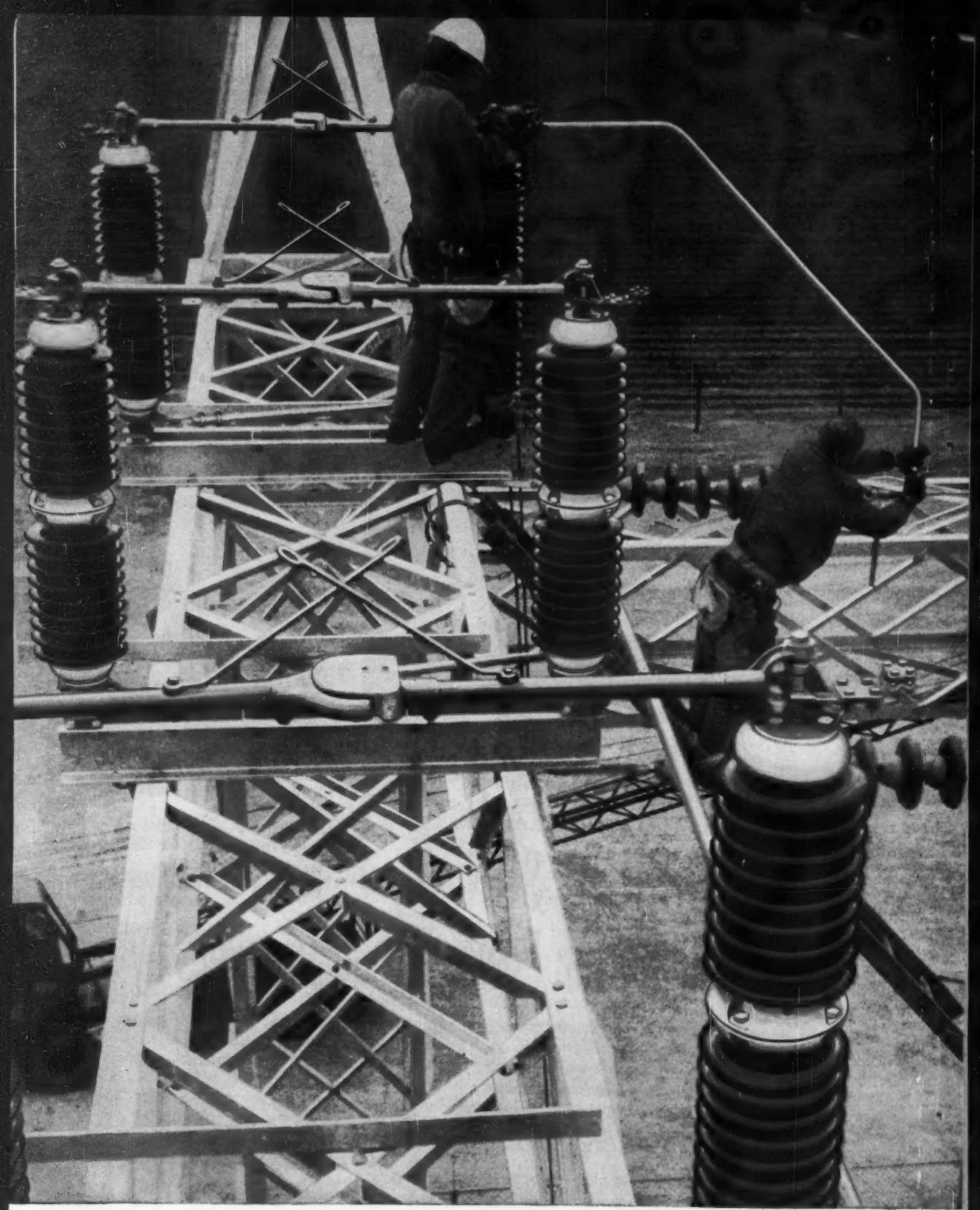
You'll find field-proven Power Circuit Breakers by I-T-E

For more than 50 years, Kelman power circuit breakers have proved themselves the hard way—successfully standing up under the most rugged environments. Under all kinds of adverse conditions, from snow and ice to desert sand and sun, from whipping rains to fast-changing mountain temperatures, thousands of Kelman breakers have weathered the years and stood the test of time.

Now part of I-T-E's broad line of established electrical equipment, the latest improved oil breakers from the Power Circuit Breaker Division are offered nationally through all I-T-E sales offices. Available in transmission, subtransmission, and distribution ratings, these breakers stand ready to serve under any conditions anywhere in the United States.

For descriptive literature on I-T-E's field-proven power circuit breakers, write to 1667 North Main Street, Los Angeles 12, Calif., Dept. EWO-961-2.

I-T-E CIRCUIT BREAKER COMPANY
KELMAN POWER CIRCUIT BREAKER DIVISION



Southern States 115 kv, 600 ampere Type GG switches being installed. The GG is available in voltage ratings from 34.5 kv – 161 kv and continuous current ratings of 600 and 1200 amperes.

KEEP PACE WITH ELECTRICAL

CURRENT FOLLOWS LOW RESISTANCE PATH THROUGH SOUTHERN STATES' BRAIDLESS AIR SWITCHES

Southern States has solved the big problem of providing efficient current transfer in high pressure, braidless side-break air switches. A unique design overcomes any question of reliability in the two current-carrying swivel assemblies inherent in this type of switch.

As a result, in the new Southern States Type 57L and Type GG you can now be assured of low resistance through each swivel assembly, adequate capacity for short circuit currents, and freedom from corrosion and contamination.

This is accomplished by the four-piece swivel units* consisting of carefully machined terminal and blade castings, hinge pin, and pressure clamp —securely bolted together so that the pressure clamp and terminal casting fit into deep, matching grooves on the hinge pin. The silver-plated grooves provide a natural barrier to foreign matter, act as a stable bearing surface for the terminal, and furnish a liberal contact area. The assembly is permanently sealed with a non-aging lubricant.

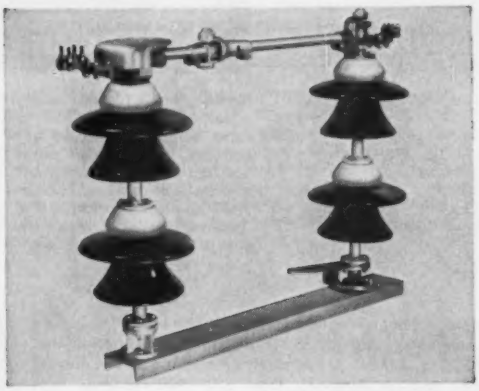
The hinge pin and terminal casting are kept under high pressure by a stainless steel coil spring (insulated by a nylon spacer) to establish the most efficient current interchange point.

The entire assembly, although under high pressure, rotates smoothly—without binding or wedging. It operates satisfactorily under short circuit conditions and well within the limits defined by NEMA for continuous current performance.

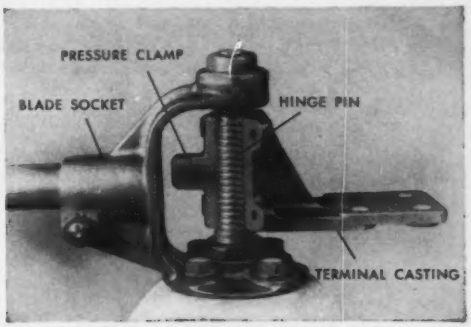
AMPLITACT® contacts are added assurance of contact performance under extremely high fault currents.

For complete details on these new braidless switches, contact your Southern States representative or write directly to us.

*Toggle point of 57L switch blade uses modified version of this assembly.



Type 57L braidless side break available in voltage ratings from 7.2 kv - 161 kv and continuous ratings of 600 and 1200 amperes.



SWIVEL ASSEMBLY—CUTAWAY VIEW

The GG uses the swivel assembly shown as the pivot on both rotating insulators. The 57L uses an identical assembly on its rotating insulator and the same construction principle at the toggle point of the 57L blade.

SOUTHERN STATES EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto

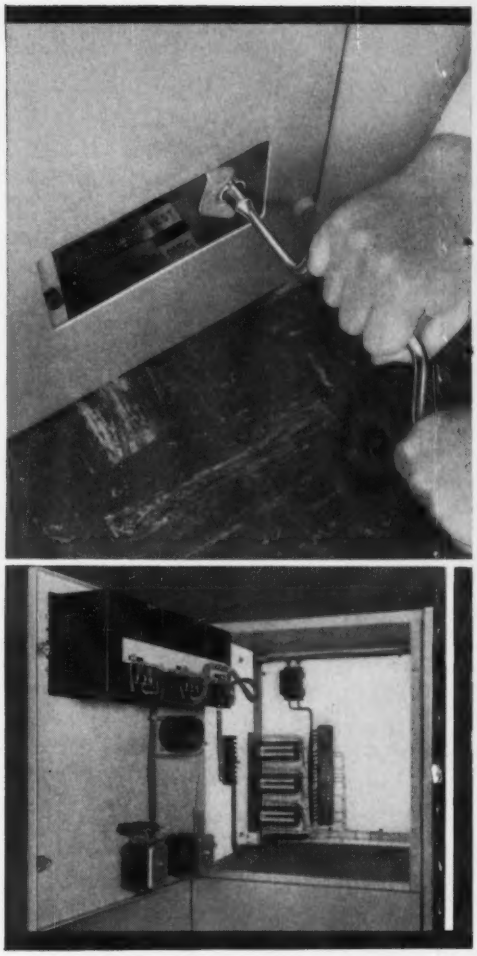
NEW COMPACTNESS

NEW SAFETY

NEW EASE OF ACCESS

NEW STORED ENERGY

This is the all-new I-T-E type HK metal-clad switchgear

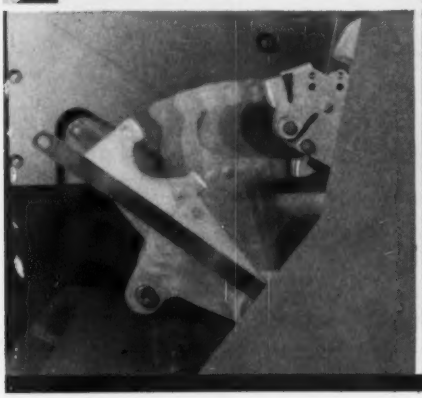


Roomy interior for easy access. Only I-T-E gives you a separate 30-in.-high instrument compartment, completely isolated from the high-voltage compartment. And it's closer to the floor, so you can reach into it easily. Put your elbows in and work in comfort. High visibility white interiors simplify installation and trouble shooting. Your control wiring can easily enter from the bottom or through the top sheet.

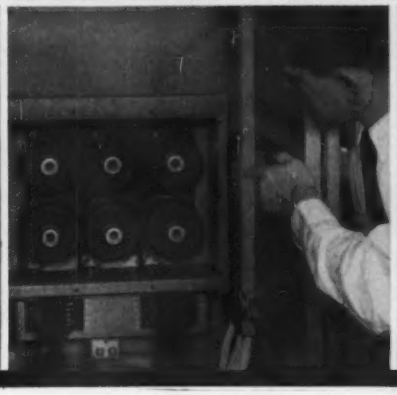
Free detailed bulletin—new strip film. Get the whole story about *all* the new advances in this I-T-E metal-clad switchgear. Learn about its easier operation, greater safety, and superior protection. Send for Bulletin 2801-2A. And ask also to see the new sound strip film. Can be shown to you singly or to your group. Contact your nearby I-T-E sales office or write I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Philadelphia 30, Pa.

Fits where others won't. This is a 4160 volt switchboard. See how low and shallow it is compared with old standards. It's only 80 in. high and 58 in. deep. So it saves both floor space and overhead space. Goes easily under low ceilings. Fits in narrower aisles. And its reduced height puts all instruments at easy-to-read eye level. Roomy cable compartments at the rear are accessible through hinged doors. All insulation in the switchboard and circuit breakers is flame-retardant and track-resistant.

Closed-door drawout. The door stays closed while the breaker is moved from connected . . . through test position . . . to disconnected and back. There's always solid steel at ground potential between the operator and the live parts of the gear. Even an inexperienced man is completely safe. Since doors stay closed, aisles need never be cluttered. And foreign matter can't get into breaker compartments.



Stored energy closing. This is not simply a new feature added to an old design. It is integrated into a completely new circuit breaker design. Gives you fast, uniform closing every time. Prolongs contact life. And you can close the circuit breakers even without control power. For greater economy, the spring charging motor draws only one-tenth the current of previous methods.



Easy-to-change current transformers. They're accessible from the front. You don't need to disturb your cable connections at all. Just remove the shutter barrier assembly over the primary studs, and there they are. As this view shows, you can locate current transformers on both load and line sides of the circuit breaker, providing more flexibility in relaying.

Compact 4160 volt circuit breaker. Low center of gravity permits easy, safe, one-man maintenance. High-strength, flame-retardant track-resistant moldings eliminate need for structural metal above the base frame. Provides insulation strength where needed most. Arc chutes tilt for easy inspection. Lift off without tools. Modern materials and new design result in substantial reduction in circuit breaker size.

I-T-E CIRCUIT BREAKER COMPANY

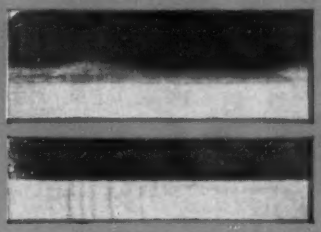
NEW!

HOT LINE CLAMPS

WITH MACHINED WIRE-BEARING SURFACES

ONLY WEAVER

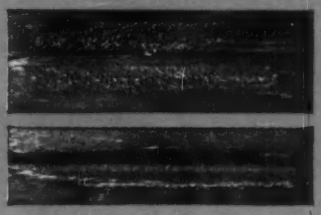
machines both wire-bearing surfaces to make them perfectly smooth, straight and parallel. Result: Full conductor contact across the clamp. No rough spots to cause arcs.



unretouched photos

COMPARE

any other clamp with Weaver. Rough wire-bearing surfaces invite trouble!



unretouched photos

WEAVER

LUBRICATED HOT LINE CLAMPS

Two sizes cover most requirements—
why carry needless inventory?

SAMPLES ARE AVAILABLE FOR TESTING BY YOUR ENGINEERING DEPARTMENT. WRITE TODAY.

J. A. WEAVER Company

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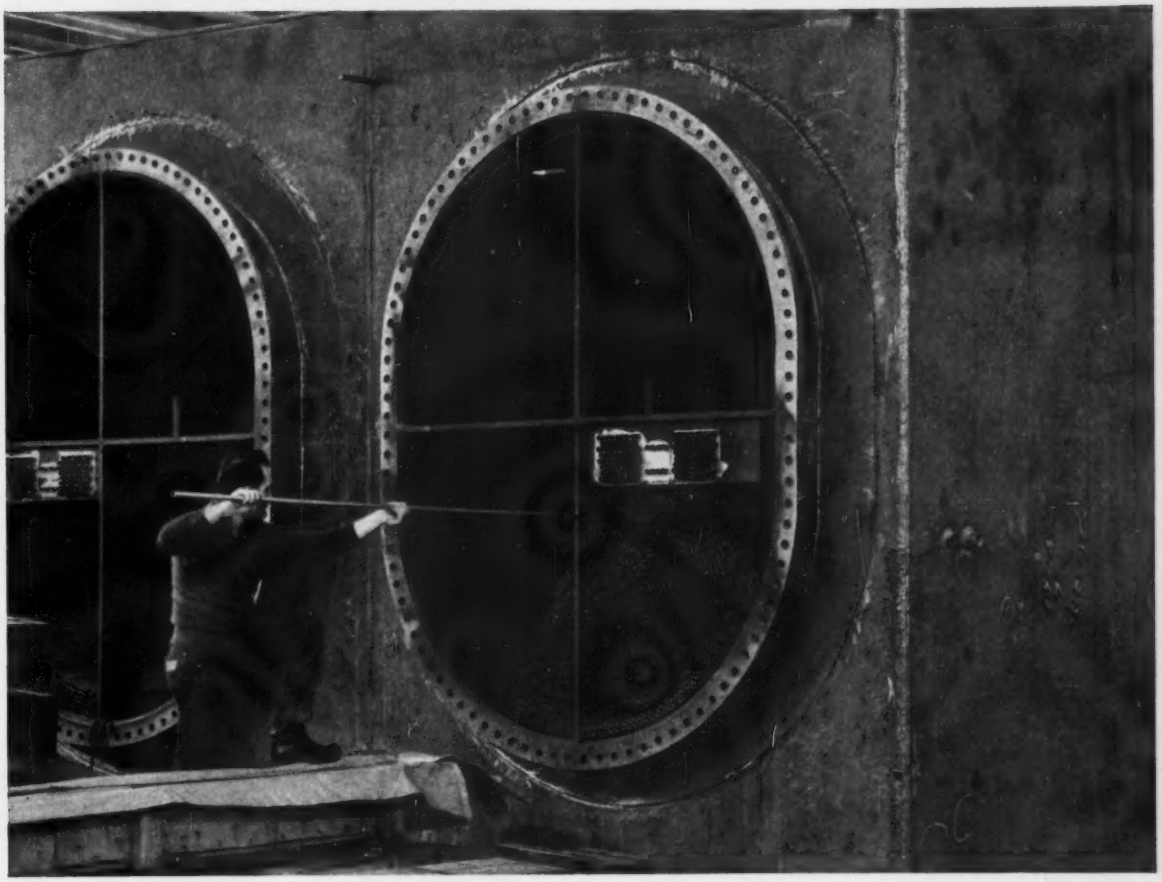
Chase BRASS & COPPER CO. WATERBURY 20, CONN.
Subsidiary of Kennecott Copper Corporation



75,000 KVA GENERATOR USES CHASE ANTIMONIAL ADMIRALTY CONDENSER TUBES—64 TONS!

9,915 tubes, 7/8" x 26' 31/16" serve 415,000 lbs/hr steam condenser. Second largest generating plant in Utah, the new Central Power Station at Magna is rated to provide 75,000 KVA. To serve its boilers, American-Standard Industrial Division (formerly Ross Heat Exchanger Division) built a condenser so large it had to be shipped to the plant site in sections.

The complete unit is a 58,000 sq. ft., two-pass surface condenser, using a total of 9,915 Chase® Antimonial Admiralty condenser tubes to process up to 415,000 pounds of steam per hour.

Chase makes various alloys that can be used in condenser and heat exchanger tubes... each ideally suited for certain combinations of heat, feed water and operating conditions. Tubes are available both straight and in U-Bend. Ask about your specific needs at your nearest Chase Multi-Metal Service Center, or write to Chase at Waterbury 20, Connecticut.

THE NATION'S HEADQUARTERS FOR ALUMINUM • BRASS BRONZE • COPPER • STAINLESS STEEL AND FORGINGS

Atlanta Baltimore Boston Charlotte Chicago Cincinnati Cleveland Dallas Denver Detroit Grand Rapids Houston Indianapolis Kansas City, Mo. Los Angeles Milwaukee Minneapolis New Orleans New York-Newark Philadelphia Pittsburgh Providence Rochester St. Louis San Francisco Seattle Waterbury

CHASE BRASS & COPPER CO.
DEPT. EW-8, WATERBURY 20, CONN.

Please send me your 64-page manual on Heat Exchanger and Condenser Tubes.

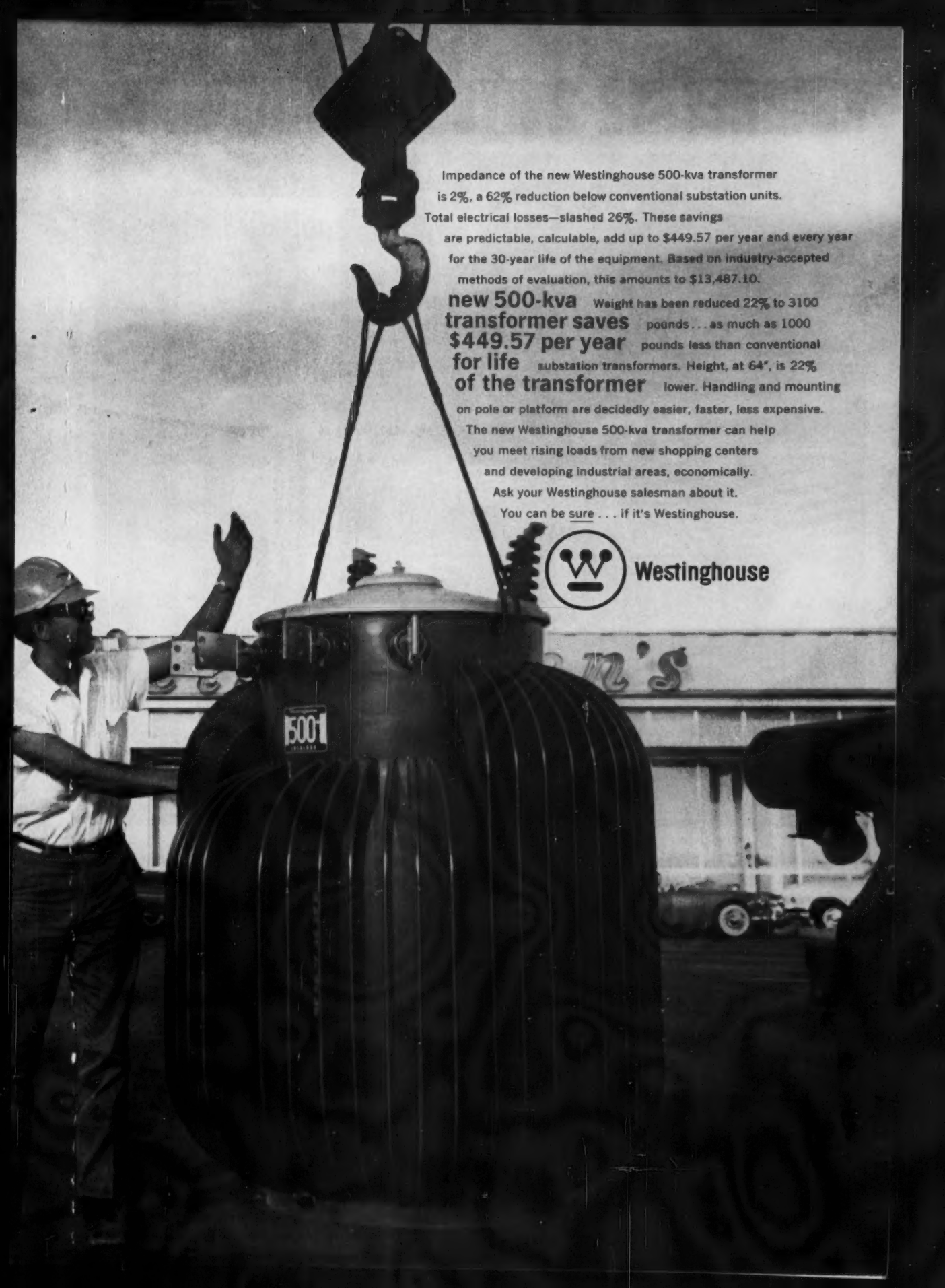
NAME_____

FIRM_____

STREET ADDRESS_____

CITY_____ ZONE____ STATE_____

TOYS



Impedance of the new Westinghouse 500-kva transformer is 2%, a 62% reduction below conventional substation units. Total electrical losses—slashed 26%. These savings are predictable, calculable, add up to $449.57 per year and every year for the 30-year life of the equipment. Based on industry-accepted methods of evaluation, this amounts to $13,487.10.

new 500-kva transformer saves $449.57 per year for life of the transformer

Weight has been reduced 22% to 3100 pounds... as much as 1000 pounds less than conventional substation transformers. Height, at 64", is 22% lower. Handling and mounting on pole or platform are decidedly easier, faster, less expensive.

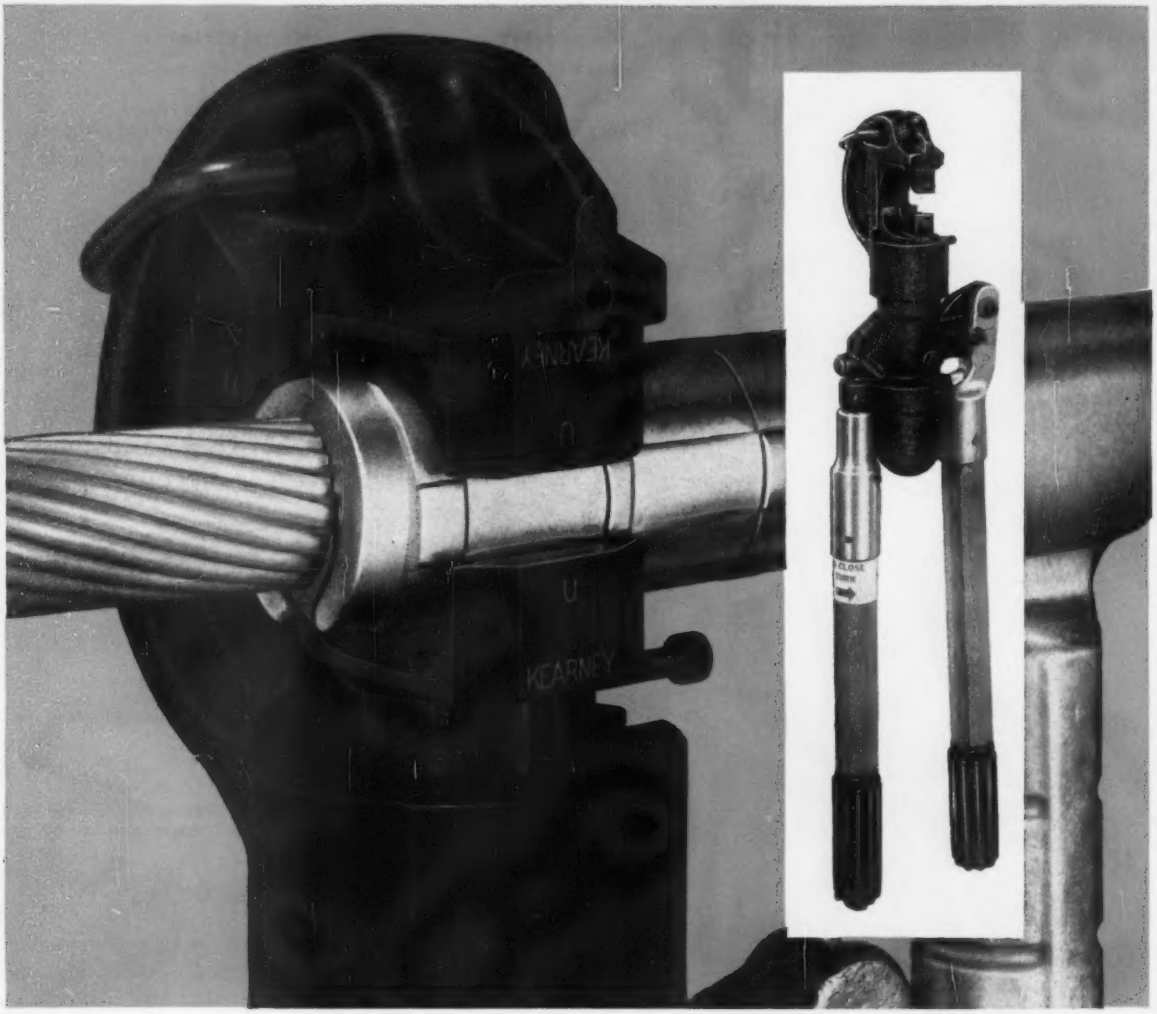
The new Westinghouse 500-kva transformer can help you meet rising loads from new shopping centers and developing industrial areas, economically.

Ask your Westinghouse salesman about it.

You can be sure . . . if it's Westinghouse.

Westinghouse

KEARNEY WH-2 HYDRAULIC TOOL AND



This is the tool... Kearney does it again! The Kearney WH-2 Hydraulic Tool—big brother to the WH-1 Tool—is the FIRST and ONLY portable, hand-operated, hot-line compression tool to accommodate such a wide range of fitting and conductor sizes. Equipped with only this ONE tool linemen can now install tap compression connectors on all sizes of energized and non-energized conductors from #6 Solid through 636 MCM ACSR! Die sizes are the same as those for the Kearney WH-1 Tool, plus the additional sizes required to install the larger fittings shown on the opposite page. Dies snap in or out easily . . . can be secured with a set-screw. A two-step, high speed pump generates full 21,000 pounds of thrust. An automatic overload valve prevents over-compression. Large C-frame head allows clear view of work area while making indents. A partial rotation of one handle sets tool to compress or retract dies—no need to remove either hand from handles. Interchangeable insulated handles are available in various lengths to adapt tool to individual voltage requirements.

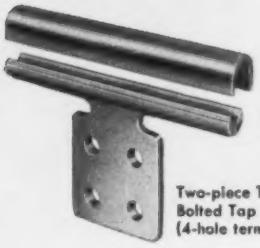
For further information, contact your Kearney

PLANTS AT: ST. LOUIS • FAYETTEVILLE, ARKANSAS • SHENANDOAH, IOWA

2-PIECE COMPRESSION CONNECTORS

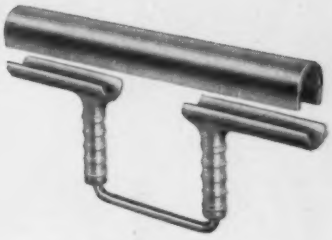
. . . extend the connection range to include installations on all "Hot" or "Cold" lines from #6 Solid to 636 MCM ACSR

Two-piece L-Squeezon Tap Connector



Two-piece T-Squeezon Bolted Tap Connector (4-hole terminal pad)

Two-piece T-Squeezon Bolted Tap Connector (2-hole terminal pad)

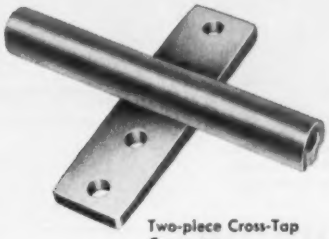


Two-piece L-Squeezon Hot Line Stirrup

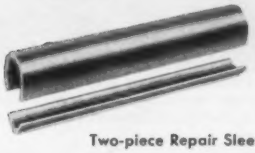
Aluminum Squeezons

Two-piece T-Squeezon Compression Tap Connector

Cast Aluminum Terminals (2 and 4-hole pad)



Two-piece Cross-Tap Connector



Two-piece Repair Sleeve

These are the fittings . . . New, larger Kearney tap connectors and the Kearney WH-2 Hydraulic Tool now extend the tap compression connection range to include installations of highest electrical efficiency on energized or non-energized conductors as large as 636 MCM ACSR. Kearney two-piece aluminum tap connectors accommodate large conductor sizes from 266.8 MCM through 636 MCM ACSR. Tap units slide into and interlock with an encircling sleeve unit. Sleeve for any one conductor size will accept interchangeably various tap units of the same size range. Kearney interlock design aids installation . . . insures uniform compression and full-circumference contact . . . eliminates strand cutting. Sufficient connector mass without excess weight assures cool-running connections. Interchangeability of tap units helps reduce storekeeper inventories.

Also illustrated: Kearney Cast Aluminum Terminals, accommodating wire sizes from #2 ACSR to 1000 MCM Str.; Aluminum Squeezons for wire sizes from #6 Solid to 397.5, line or tap.

sales representative . . .

KEARNEY

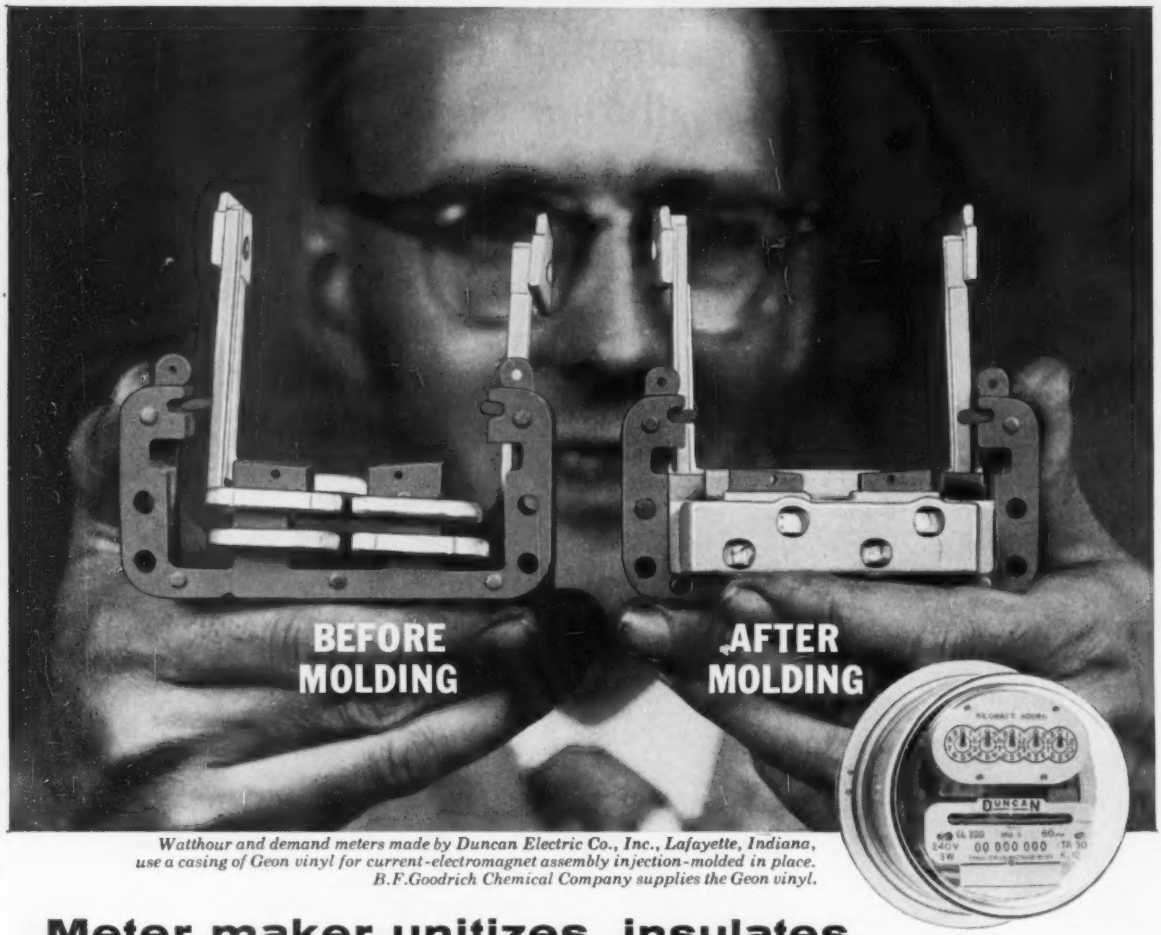
JAMES R. KEARNEY CORPORATION

4224-42 Clayton Avenue, St. Louis 10, Missouri

CLARINDA, IOWA • GUELPH, ONTARIO, CANADA • ST. THERESE, QUEBEC, CANADA

Another new development using

B.F.Goodrich Chemical *raw materials*



Watthour and demand meters made by Duncan Electric Co., Inc., Lafayette, Indiana, use a casing of Geon vinyl for current-electromagnet assembly injection-molded in place. B.F.Goodrich Chemical Company supplies the Geon vinyl.

Meter maker unitizes, insulates, and protects magnets with Geon

Geon vinyl does a three-way job for this meter manufacturer. By securing parts in position, providing insulation and protecting them against injury, Geon helps produce a better, longer lasting current-electromagnet assembly.

The manufacturer says that Geon exhibits excellent heat stabilization —it holds up well under high temperatures without exuding fumes that might corrode brass parts used in other areas of the meter. In addition, use of Geon made possible a less critical molding process, resulting in a more uniform finished piece.

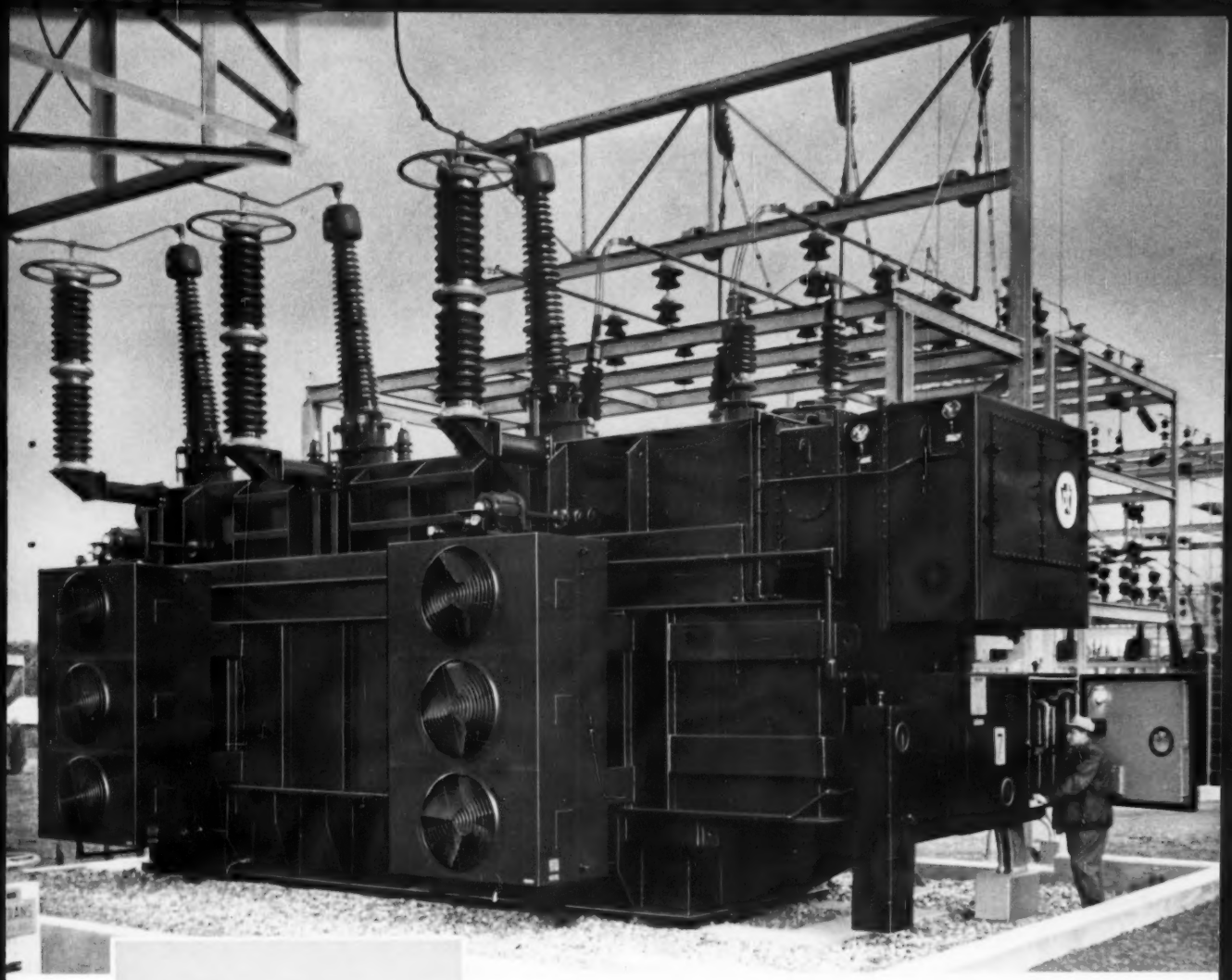
Immediately after the molding process, high voltage tests of 7500 volts are made from turn to turn and from turn to ground—proof again of the outstanding electrical properties of Geon vinyl.

Here's another example of the way that products can be improved with Geon. Why many manufacturers are using it to open whole new markets. To get more information, write Dept. GX-9, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon VINYLS

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers



150,000-kva Monument to Service . . .

Pennsylvania LTC Transformer steps down 230 kv for Potomac Electric's Washington-district lines

Located in an area where statuary and monuments abound, Potomac Electric Power Company's Takoma Park Substation could be termed a "monument" to service-minded public utilities. Its growth exemplifies the extensive and rapid expansion an electric utility must undergo to meet the challenge of population "explosion."

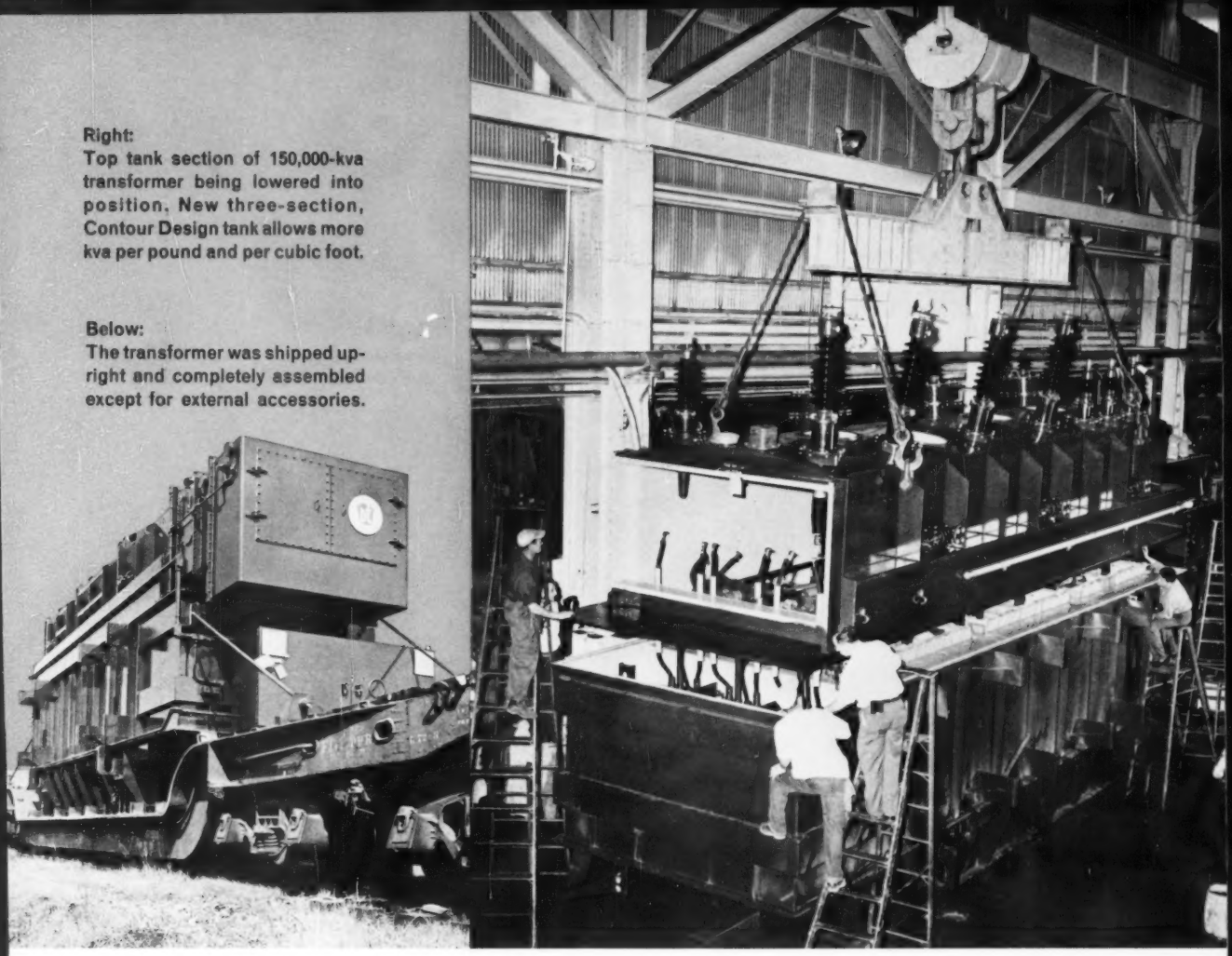
The station is in Prince George County, Maryland, a few miles from the northeastern border of the District of Columbia. The area has experienced exceptional growth, with shopping centers and light industrial plants adding to the load created by new apartments and houses. Since World War II, Potomac Electric Power has added 380,000 kva to Takoma Park's transformer capacity. The total capacity is now 440,000 kva.

The latest addition is a 150,000-kva Pennsylvania Load Tap Changing Transformer, which steps down the voltage of a new 230-kv line for Potomac Electric's main 69-kv transmission system. A combination of high kva and high voltage makes this one of the largest LTC transformers Pennsylvania has built. Thanks to its compact shell-form Contour Design, however, the transformer was shipped to its destination upright and completely assembled except for bushings, heat exchangers, and other external accessories.

A new booklet describing the construction and advantages of Pennsylvania Contour Design Transformers is now available. For a copy—or a conference regarding specific requirements—write to Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa., or contact the nearby Pennsylvania Transformer sales representative.

PENNSYLVANIA POWER TRANSFORMERS

See other side for design details



Right:
Top tank section of 150,000-kva transformer being lowered into position. New three-section, Contour Design tank allows more kva per pound and per cubic foot.

Below:
The transformer was shipped upright and completely assembled except for external accessories.

Now. . . more kva per pound and per cubic foot in Pennsylvania Contour Design power transformers

NEW 3-SECTION TANK

reduces sound level, too!

Pennsylvania shell-form Contour Design transformers are now lighter, more compact . . . and structurally stronger . . . as a result of a new three-section tank design. The core and coils are assembled in the base section *without the use of a separate frame.* The center tank section, when added and welded into place, provides sturdy side bracing for the internal assembly.

Before the top section is added, the core is clamped to the bottom section by means of closely spaced jack screws. Careful control of the jack-screw pressure reduces the sound level of the entire structure . . . assuring even quieter operation than heretofore.

The 150,000-kva, 230-kv transformer shown above and on the reverse side demonstrates a prime advantage of Pennsylvania's new size-and-weight-reducing Contour Design. A combination of high kva and high voltage makes this one of the "largest" load tap changing transformers Pennsylvania has built . . . yet it was shipped upright and completely assembled except for external accessories.

Now in service for Potomac Electric Power Company, the transformer includes LTC equipment for plus or minus 10% regulation in 32 steps of $\frac{5}{8}$% each—all at full capacity. The 69-kv secondary and 13.8-kv tertiary may be loaded simultaneously.

McGRAW-EDISON

PENNSYLVANIA TRANSFORMER DIVISION
McGRAW-EDISON COMPANY • CANONSBURG, PA. • GREATER PITTSBURGH DISTRICT

PENNSYLVANIA TRANSFORMERS

See other side for installation view

The Electrical Week

LATE NEWS

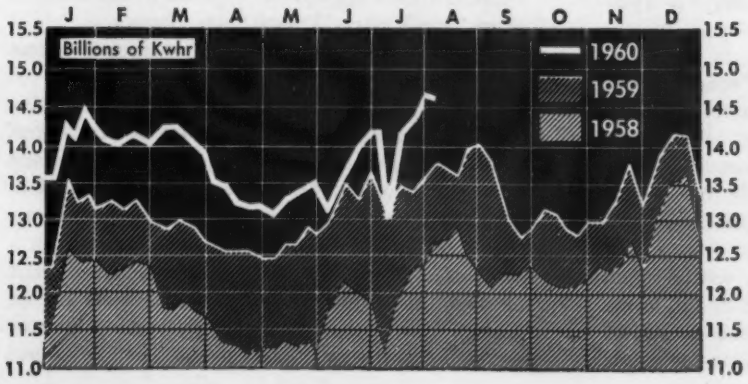
Atom Items . . . Tampa Electric and Florida Power Corp delay construction of 50-Mw gas-cooled prototype reactor one to two years while substitution of beryllium for stainless steel cladding is studied. Additional financing will be sought from other private utilities to meet increased costs. Fourteen other companies are already participating . . . Hawaiian Electric gets court okay on 445-acre site for 100-Mw nuclear plant after earlier turndown. Construction will start about 1963.

Finance . . . FPC 1958 utility depreciation report shows 92% of 263 companies surveyed using straight line method. Report indicates continued trend toward this method . . . Portland GE strives to locate holders of $750,000 worth of stock of defunct predecessor companies. Stock must be turned in before next June for valid PGE stock . . . Six US banks are carrying on books $8-million unsecured loan, now past due, to Cuban Electric Co, just grabbed by Castro (p 62).

Around the States . . . Oregon AFL-CIO convention reverses stand, refuses to okay legislation to set up State Power Commission. Meeting also turned thumbs down on proposals to endorse Nez Perce or High Mountain Sheep dams. Union group fears labor would lose protection of state and federal labor laws under public ownership . . . New high performance electric car designed to test public reaction and possible market for minimal transportation vehicle is announced by Detroit Testing Laboratories, Inc . . . Boiler makers' strike slows construction of three utilities' power plants. Included are Philadelphia Electric's Eddystone, Pen P&L's plant near York Haven, Pa, and Delaware P&L's Tidewater plant . . . Textile firms ask N.C. Utilities Commission for hearing on increases on Carolina P&L rate modernization proposals . . . Ohio Supreme Court denies city of Columbus rehearing on Columbus & Southern rate increases. Decision okays 6% return for city service and 4.7% for county service . . . Indiana legislature committee will recommend staggering terms of three-man Public Service Commission and requiring that two of three be attorneys.

Management changes . . . Roy McKenzie Sr, vice-chairman of Electric Power Board of Chattanooga, is appointed chairman, subject to confirmation by the City Commission.

WEEKLY POWER OUTPUT—Up 7.6% (Week Ending August 6), Kwhr 14,709,000,000



Per Cent Change From Previous Year

	July 23	July 30	Aug. 6
Total U. S.....	+ 6.2	+ 7.1	+ 7.6
New Eng.	+ 2.1	+ 3.7	+ 7.2
Mid. Atlan.....	+ 1.7	+ 1.9	+ 1.2
Cent. Ind.	+ 5.1	+ 7.2	+ 7.8
West Cent.	+10.8	+ 8.2	+ 3.7
Southeast	+ 6.8	+ 4.7	+ 6.4
South Cent.....	+ 8.2	+18.8	+ 6.3
Rocky Mount ..	+ 5.7	+ 7.2	+11.8
Pacific			
NW	+ 5.6	+ 4.9	+ 5.2
SW	+12.9	+ 9.9	+ 7.7

Seasonally Adjusted Index 268.8

Week Ago 272.3 Year Ago 253.6

Source: Edison Electric Institute

Preview of This Issue

EVENTS ▶ **Missouri's governor orders striking electrical workers back to work** at Kansas City Power & Light Co as negotiations break down **(p 58)** . . . Cuban Electric Co taken over by Castro regime **(p 62)** . . . US and Canada continue talks on Columbia River **(p 60)** . . . Construction of Oroville Dam threatened by lack of funds **(p 61)** . . . Bonneville makes tentative power allocations **(p 63).**

ENGINEERING ▶ **How to keep station operators up-to-date?** That's the problem Oklahoma Public Service solves **(p 64)** . . . Transmission system costs are minimized by using a "Desired Generation Computer" which takes into account transmission and incremental generating losses. VEPCo estimates the new system will net an annual saving of $50,000 **(p 66)** . . . Custom transformers for residential underground permit easy replacement without disturbing primary circuit. Installed near Little Rock, the underground's excess costs are shared by Arkansas P&L, the developer and the customers **(p 68)** . . . West Germany's Goldenberg Power Plant is tied to overhead high-voltage network by a 220-kv cable. Virtually trouble-free history since the cable was installed in 1952 prompts further testing and utilization. Use of "elephant heads," funnel-shaped chambers, achieve $12,000 saving by direct introduction of the cable into the transformer housing **(p 70).**

PROCUREMENT & PRODUCTS ▶ **Purchasing function is being upgraded** in many businesses. Labor Department study shows a college degree is becoming increasingly important for promotion, and business school graduates are preferred by many employers, while others

Politics and Public Power

REGIONAL PLANS ADD UP TO SUPER GRID

There are many plans for "giant power" systems in the mill—and added together they would amount to a single, super-grid over much of the United States. Whether they ever become a reality is a matter of purest conjecture, but at least the various groups sponsoring them believe they are reasonable, and are presenting them as such. Of course, some parts of the super-grid already exist and other parts are far enough along in planning and construction stages to allow the assumption that they will exist. In some cases the question of ownership is still not clear.

In a clockwise direction (starting at "one o'clock"), the lines would interconnect: the Bureau of Reclamation's Upper Missouri Basin Project, the Upper Colorado River Project, Lower Colorado System, the Central Valley Project, Bonneville Power Administration, and back to the Missouri Basin.

These are the proposed lines:

Bonneville and Central Valley—A special study by H. Zinder & Associates, sponsored by California Gov Edmund Brown, will recommend a 500-kv interconnection between these systems later this year to the Senate Interior Committee. Justification for the line will include construction of a 300,000-kw coal-burning generation plant at Cle Elum, Wash.

Central Valley and the Lower Colorado System—The same Zinder report will call for tie lines between the south end of Central Valley and Hoover and Glen Canyon Dams. This will include the need to give Colorado River preference customers added power supply while the filling of Glen Canyon Dam cuts into power deliveries from Hoover. Zinder adds in a preliminary report that the connection of Hoover, Glen Canyon and proposed Bridge Canyon Dams, via Central Valley, with Bonneville, could add up to 800,000 kw of firm power through system diversity.

Bonneville and Missouri Basin—The Mid-West Electric Consumers Assn, made up of power-consuming co-ops and municipals, is advocating the construction of a 500-kv line from near Sheridan, Wyo., to an adequate Bonneville load center sometime shortly after 1975. This line is proposed in a study of a Missouri Basin power pool, and is part of a series of proposed 345-kv lines within the Basin. Also in the proposal are several federal or preference customer thermal plants on the Missouri

prefer men with a solid technical background **(p 80)** . . . Two gas-insulated power transformers are received by a western utility for installation in an outdoor substation. GE's 12.5 Mva, 115 to 12.5-kv units are highest rated of this type ever built . . . Pioneer Electric Ltd, Canadian electrical equipment manufacturer, is acquired by Federal Pacific Electric for about $5 million in cash and stocks **(p 82)** . . . Relay protects against excess or reverse power flow. Available for 120 or 208-v applications, the units do not require external reactors . . . Left or right-hand offsets to meet substation or pole structural needs are featured in fuse-switch tandem for bypassing breakers and reclosers . . . Oil cutouts for 7.8 and 15-kv circuits carry 200 amp. Units are available in 5,000 and 7,000-amp interrupting capacities, respectively **(p 92).**

BUSINESS OUTLOOK ▶ **$45 billion will be spent for new plants in the Sixties** by the nation's biggest power customer—industry. That means big new loads for some utilities; but much less for others. Many companies will shift their operations to new areas. For a look at the key forces behind industry's building boom, turn to **page 99.**

SELLING ▶ **Lack of humidity this summer has taken its toll** on air conditioner sales at the dealer level. Manufacturers, however, are optimistic **(p 103).**

NEXT WEEK ▶ **Battering hurricane winds** sweep by Florida P&L's 230-kv transmission line.

system to add firm power (EW, Aug. 8, p 28).

Missouri Basin and Upper Colorado River Storage Project Lines—The Mid-West group aims another proposed 345-kv line from Gering, Neb., on the Missouri system, to the Denver load center. This could be used to tie the Missouri system with Public Service Co of Colorado or nearby federal lines—the proposed Upper Colorado transmission network or the Fryingpan-Arkansas Project—at several locations, including Pueblo, Colo.

Upper and Lower Colorado Systems—These would be connected by the proposed lines from Central Valley to Hoover (lower) and Glen Canyon (upper) dams, and through another proposed interconnection, probably at Phoenix, Ariz. The Interior Department is presently considering plans by five electric companies in the area to build the major transmission grid between the federal Colorado River dams, as an alternative to federal lines, but no decision on this has been announced.

Also included in the Interior Department's proposed Colorado River Storage power grid—either federal or private—would be a 115-kv line connecting the project with the federal Red River hydro dams in New Mexico.

OROVILLE DELAY COULD AFFECT VOTE

There is some question whether Oroville Dam will be constructed in the early stages of development of California's Feather River project (p 61).

Harvey O. Banks, director of water resources, privately believes that it will not be delayed—that the state will build it if a way to finance it can be found. A flood in the Yuba City area cost some 40 lives in 1955, and this reason alone provides incentive to make every effort to avoid delay on Oroville. Elimination of the dam from the gigantic California Water Plan could cost a lot of votes when the bond election for the project comes up in November—especially in Northern California.

Southern California support for the project would probably be strong enough to carry the bond vote anyway. Recent polls show that the bonds should be favored by 64% of the voters, with the major support coming from the south.

The state has an alternate plan for at least a flood control dam at the Oroville site just in case the project as a whole cannot be financed. This may be the pop-off valve that would save the bond election if pressures build too high.

Executive Reader

Many businessmen are now using only 20% of their reading capacities. They are reading less than 250 words a minute—the average for businessmen generally. This is because they read word by word, at a rate not much faster than they can talk. Trained readers can attain speeds of 1,000 words per minute, and more. (A 12-page pamphlet is available at no cost. Write the Editor, *Electrical World*.) **How to Cut Your Reading Time, McGraw-Hill Publishing Co and The Reading Laboratory, Inc, 330 W 42nd St, New York 36, N. Y.**

The cost of money is an important consideration in a determination of a fair return, but should not be the sole test of reasonable earnings. While the ability to attract capital is always a necessary consideration in connection with allowable earnings, it has serious limitations. The subject should be approached with full knowledge of the pitfalls. **The Relation Between a Fair Return and the Rate Base, John H. Bickley, Public Utilities Fortnightly, August 4, 1960.**

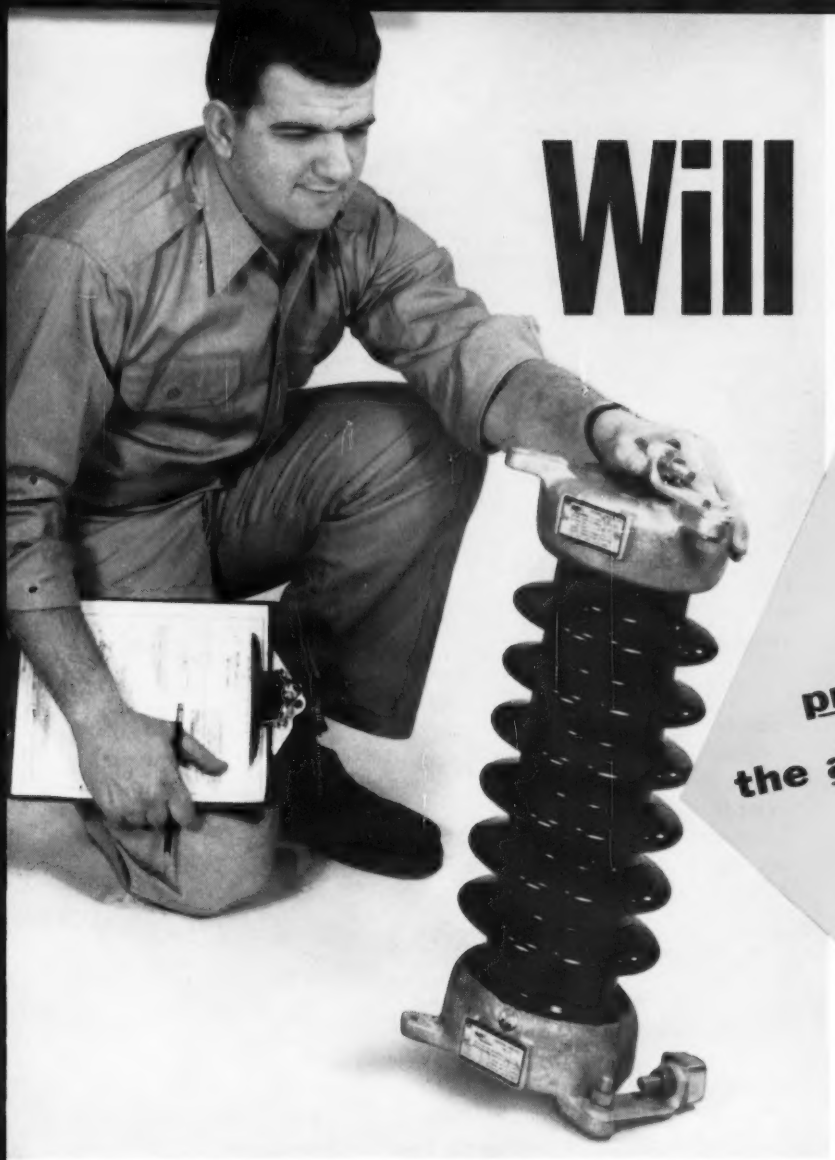
Last year (1959) the academic institutions of the US graduated less than 1,000 doctorates in engineering and the applied sciences. Moreover, the number is not increasing appreciably. Something is seriously wrong. Indeed, these numbers are so far from requirements in our growing industrial nation that a little patching here or there cannot possibly correct the deficiency. **L. V. Berkner, remarks at the 68th annual meeting, American Society for Engineering Education, Purdue University, June 22, 1960.**

Most government action involves coercion—outright coercion in the administration of justice, but also coercion through the taxing power. Such coercion is necessary if there is to be any government at all. But precisely because government must have large coercive power the scope of its action requires limitation, and it is the great strength of the US constitutional system that it plainly recognizes this necessity. **Fortune, August, 1960.**

By 1970, the average work week in the US may be as much as three hours shorter than the current work week, output of the US economy will exceed $700 billion, per capita income will rise from $1,900 to $2,300, and personal outlays for goods and services are likely to be double the volume of such expenditures in 1960. **The Decade of Incentive, McCann-Erickson Inc, 485 Lexington Ave, New York 17, N. Y.**

Russian scientists admit that in the development of electronic computers they are four years behind the US and Great Britain. **Electrical Journal, July 15, 1960.**

When atomic energy licenses are issued, prompt notice should be given to the communities in which licensees are to operate. At present, although the locality may be the first to get the impact, it is often the last to know. **The Community Impact of Peaceful Uses of Atomic Energy, US Atomic Energy Commission.**



Will it do?

Here is a practical test for the adequacy of Thorex intermediate class arresters

What test is there for the adequacy of O-B intermediate class arresters for today's load and equipment protection? Here is a very practical approach to this question.

How many stations do you now operate, built in the period between 1949 and 1957, and protected with the highest grade (station class) arresters then available? Is this protection still satisfactory?

Today's Thorex Dynagap Type GP intermediate class arrester offers you at least the same, and in many cases much greater protection, than the most costly arresters installed in your stations three to ten years old. The Type GP sells for about half the equivalent rating in station class. Therefore, if you are faced with the problem of budgets vs. protection, the low-price Thorex Type GP may very well be your answer on the basis of a direct comparison with your own existing equipment.

Characteristics of the Type GP arrester are not common throughout the industry - - they are highly *uncommon*. They are typical of the big surplus value that has brought Thorex into prominence. When you must combine low cost and high protection, you can put complete dependence on the Type GP Thorex Dynagap arrester.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10012-H1

Do these fit you?

The new O-B stacking Unipost is interchangeable in its stacking position - - the identical unit goes in the top, intermediate, or bottom position. No more single-purpose stacking units. No more confusion in the warehouse or on the construction site. No more needless, triple inventory.

This applies to *all* Unipost combinations. But, some offer a still further advantage. Certain Unipost units act as components for two or three different BIL ratings, depending only on the number of identical units used. If this is the case, just one Unipost catalog number in your stock will build or maintain two or perhaps three different BIL-rated stacks. The chart here tells the story. Study it carefully. It may offer a lot of saving - - in money as well as trouble.

O-B has modernized the stacking insulator with its new Unipost - - simplified its application - - reduced its inventory cost - - improved basic post design.

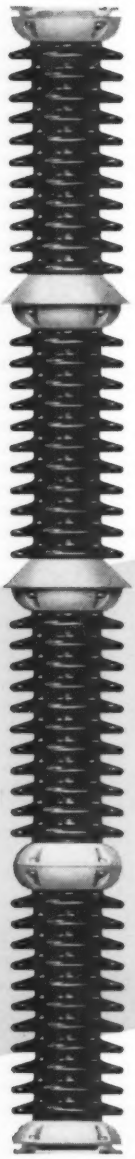
When you specify new switchgear, or when you plan new stations, be sure to include the new O-B stacking Unipost.

OHIO BRASS COMPANY • MANSFIELD, OHIO

Ohio Brass

HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES



If your station insulation fits any of these popular patterns, your cost of stacking post insulator inventory can go 'way down!

Unipost unit catalog numbers, and the complete stacks each unit will build. The same unit fits all stacking positions. There are additional Unipost units and stack combinations. For the complete series, see new O-B Switch and Bus Insulator Catalog No. 32, or O-B Publication No. 1459-H.

10012-H23

STANDARD STRENGTH

HIGH STRENGTH

EXTRA HIGH STRENGTH

Normal Range of Application
Operating Voltage kv

650 kv BIL
900 kv BIL

Unit No. 47975

138 • 161
195 • 230 • 287

750 kv BIL
1050 kv BIL

Unit No. 47977

161 • 195
290 • 287

825 kv BIL
1175 kv BIL

Unit No. 47984

195 • 230
330

650 kv BIL
900 kv BIL
1300 kv BIL

Unit No. 47985

138 • 161
195 • 230 • 287
287 • 330

750 kv BIL
1050 kv BIL
1470 kv BIL

Unit No. 47987

161 • 195
230 • 287
460

825 kv BIL
1175 kv BIL

Unit No. 47994

195 • 230
330

650 kv BIL
900 kv BIL
1300 kv BIL

Unit No. 47995

138 • 161
195 • 230 • 287
287 • 330

750 kv BIL
1050 kv BIL
1470 kv BIL

Unit No. 47997

161 • 195
230 • 287
460

All done by sun-down

New O-B pothead saves enough time to get oil-filled cable under permanent seal in a working day

It might sound like splitting hairs to talk a few hours' time saving on a job as expensive as building a high voltage pothead. Yet, it's a fact, these few hours are very valuable!

Modern O-B capacitor-graded potheads have many components that are factory assembled - - many more that are considerably simplified. The construction crew can leave the job at quitting time with an O-B pothead completed.

This means that the oil-filled cable need not be under temporary seal over night. Risk of exposure is cut materially. Ask your cable man what it means to clean up a pothead in a day's time, and have it under permanent seal by sun-down. Here is where the time saving of O-B potheads really pays off.

This is just one of many features of O-B's new terminal equipment. It will pay you to know the whole story before you plan any new construction. You can get it from your O-B representative or by writing us direct.

OHIO BRASS COMPANY, MANSFIELD, OHIO

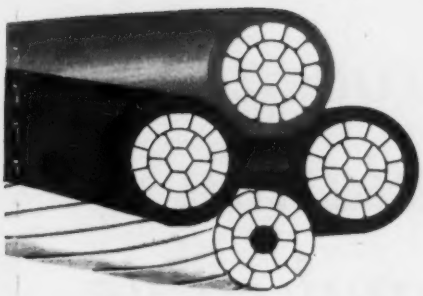
Ohio Brass (B) HOLAN

PORCELAIN INSULATORS • LINE HARDWARE • CAPACITORS • LIGHTNING ARRESTERS
BUSHINGS • HOLAN TRUCK-MOUNTED POWER DEVICES AND BODIES • BRONZE VALVES

10012-H4

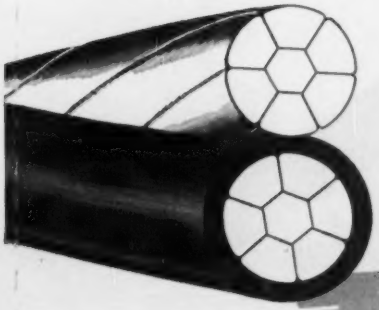
COLOR EVOLUTION

Triplex Secondaries by **SOUTHERN ELECTRICAL** Take on Lasting Color With **HYPALON®***



COLOR-CODED CABLES Insulated With HYPALON® Have These Major Advantages:

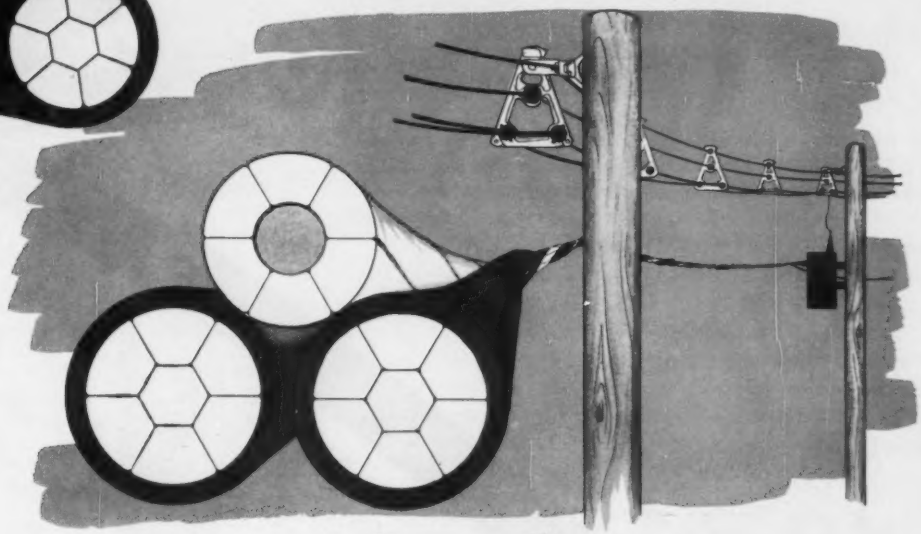
- Positive phase identification, permitting load balancing;
- Available in black, electrical red and electrical grey;
- Outstanding resistance to ozone;
- Excellent resistance to heat, chemicals, flame;
- Improved resistance to compression cutting when used on COMPRESTO®;
- HYPALON® can be stripped freely at field temperatures;
- Electrical properties of HYPALON® permit its being rated as a 600-volt class multiplex cable.



*Synthetic rubber covering with properties that exceed Two-Coat coverings for service drop cables.

Hypalon® is a registered trademark of E. I. du Pont de Nemours & Co., Inc.

Compresto® is a registered trademark of Southern Electrical Company.



Southern Electrical Company

OLIN MATHIESON • METALS DIVISION • CHATTANOOGA, TENNESSEE

OLIN ALUMINUM

SEE NEXT PAGE

Another new development from Du Pont:

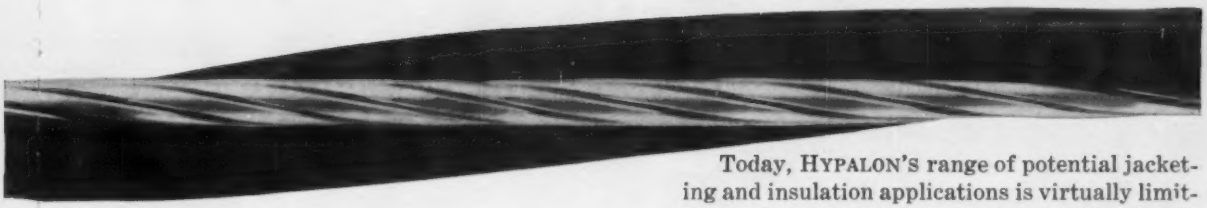
Hypalon®...an improved jacketing and insulation material for wire and cable

New insulated secondary phase wire introduced by Southern Electrical Company, using a HYPALON compounded jacket, is available in black, gray or electrical red. HYPALON's excellent color retention means positive phase identification, easier tap-in. New cable has a 600-volt rating.

New synthetic rubber combines excellent mechanical and aging properties...permits color coding of high-performance triplex secondary cable

The key improvement in this new triplex secondary cable is jacketing and insulation of tough, weather-resistant Du Pont HYPALON. Designed to meet the requirements of increased power consumption—brought on by a growing population and heavier industrialization—the cable relies on new Du Pont HYPALON synthetic rubber to provide a combination of properties found in no other jacketing material.

For example, HYPALON's permanent colorability now permits color coding of secondary network cable for positive phase identification. Its exceptional resistance to heat and flame assures safe, dependable operation during periods of severe electrical overload. HYPALON's outstanding resistance to weather, aging, ozone, sunlight, abrasion, oil and chemicals means long life and economical performance under every condition encountered in rugged line service. And HYPALON's electrical properties permit a single extrusion to act as both insulation *and* jacket . . . resulting in a significant reduction in wall thickness.



Today, HYPALON'S range of potential jacketing and insulation applications is virtually limitless. On service drop wire, it meets the highest requirements for insulation . . . provides needed resistance to burning or flowing at high temperatures. Other potential uses include spaced aerial cable (rated at 15 KV and up), direct burial power cable, automotive wire, mine trailing cable, building wire and appliance cord. Explore the many ways HYPALON jacketing and insulation can improve performance of the cable you use. For information, write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Dept. EW-8, Wilmington 98, Delaware.

Atop a utility pole, a Community Public Service lineman strings Compresto® triplex secondary wire near Texas City, Texas. CPS was the first to install new HYPALON jacketed secondary cable.

HYPALON®
SYNTHETIC RUBBER

DU PONT
REG. U. S. PAT. OFF.

Better Things for Better Living
. . . through Chemistry

Before it is shipped every

run-in and tested

Part of Onan's testing facilities—largest electric generating plant testing area in the industry!

Big, brawny bearings on Onan engines—twice the bearing area of most competitive bearings. Means longer life between overhauls. Another of many ways that Onan is built *up* to performance, not built down to a price.

Stellite coated exhaust valves and valve seats. One of toughest alloys known. Gives you up to 300% longer valve life than uncoated valves. It's the important details like this that make Onan more economical in the long run.

Onan Electric Plant is for hours

And we mean every Onan Electric Plant! This rugged workout under load means every Onan is ready for hard work the day you get it!

Every Onan plant has a nameplate with horsepower and output ratings. Every single plant is put through a series of tough tests to make sure it does what the nameplate says it will do *before it is crated for shipping.*

But this isn't enough. Inspectors from an independent laboratory pay our factory frequent surprise visits. Their job is to check and double-check—our tested plants as well as our testing equipment and methods. They pull a plant off the line, run it, stop it, gun it, stall it, check and recheck. The end result is Onan's exclusive *Performance Certification* . . . your guarantee of getting the power you paid for.

See the dependable Onan Generating Power Plants soon. You can find an Onan distributor in the Yellow Pages in every major city, or write direct.

ONLY ONAN GIVES YOU THIS CERTIFICATION

PERFORMANCE CERTIFIED
We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.
D. W. ONAN & SONS INC.
Minneapolis 14, Minnesota
Onan

Onan®

World's Leading Builder of Electric Power Plants

D. W. ONAN & SONS INC., 2654 UNIVERSITY AVE. S.E., MINNEAPOLIS 14, MINN.

A 5000° flame takes ten minutes to penetrate a one-quarter inch piece of CDF's new Dilecto RD-105 laminate. The same thickness of cold-rolled steel is pierced in less than forty seconds.

Molded from graphite fabric impregnated with a heat (ablation)-resistant phenolic resin, new CDF grades RD-105 and RD-115 are being evaluated in solid propellant rocket motors.

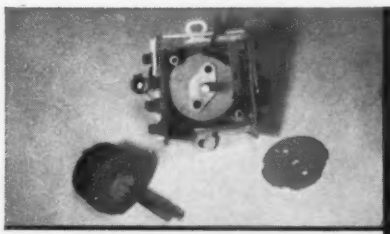
Dilecto laminates are only one family of products from industry's largest selection of non-metallic structural materials and electrical insulations. Vulcanized fibre, silicone rubber and mica, and thermosetting moldings are also supplied by CDF.

CDF can provide both quality and true economy in selecting plastic materials best suited to your needs. Refer to SWEETS PD file or write to us for General Folder 60.

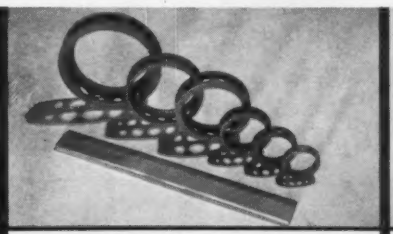
CONTINENTAL-DIAMOND FIBRE

CDF® A SUBSIDIARY OF THE Budd COMPANY • NEWARK 15, DEL.

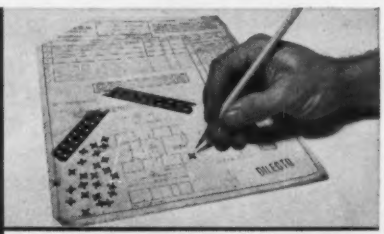
In Canada, 46 Hollinger Road, Toronto 16, Ont.



Moisture-resistant and low cost Dilecto cams for automatic washer and dryer controls.

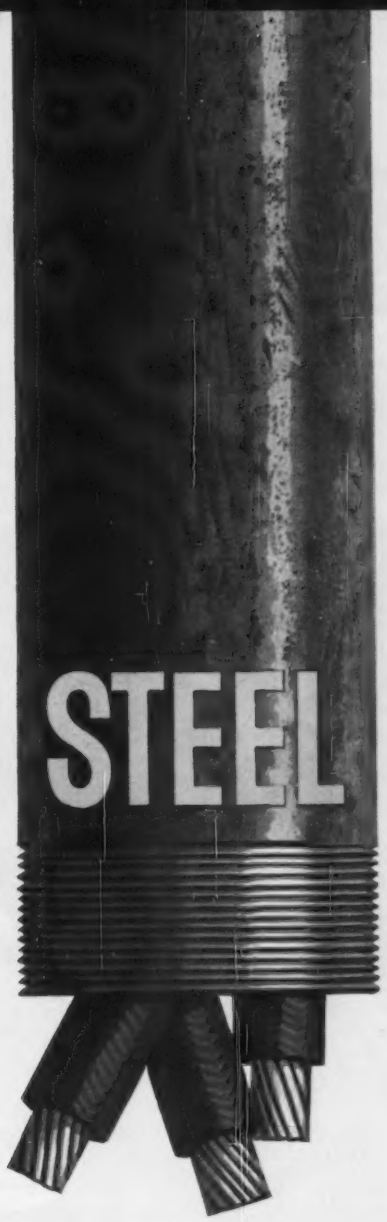


Dimensionally stable, light weight, oil-resistant Dilecto ball bearing retainer rings.



Easily fabricated paper-base, punching grade Dilecto precision switch insulators.

RIGID STEEL CONDUIT



protects electrical wiring permanently . . . guards against physical damage . . . combats the hazards inherent in any wiring system. After 50 years of service, rigid steel conduit is still the strongest answer to your electrical raceway problems.

Before you specify your next job, check with the leading manufacturers of steel electrical conduit, many of whom build their products from Bethlehem steel—EMT from Bethlehem steel sheet; rigid conduit from Bethlehem steel pipe. Or ask your electrical distributor for comparative details.

Steel

for Strength
. . . Economy
. . . Versatility

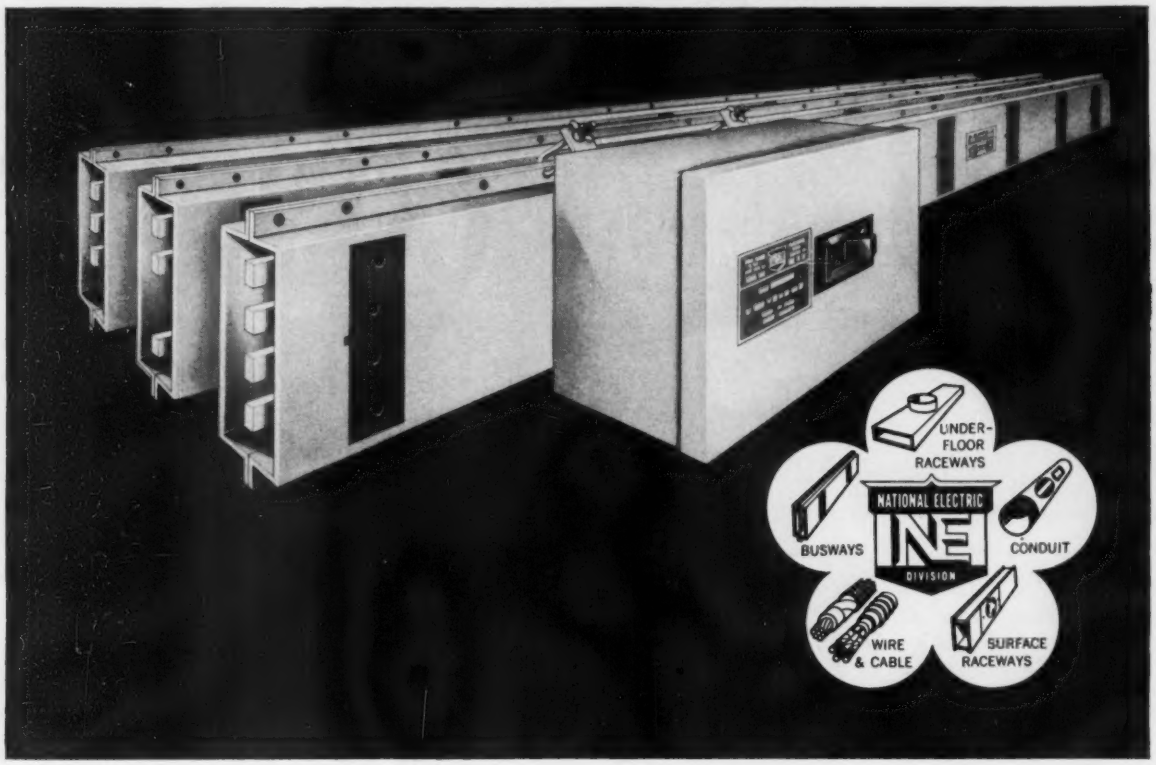
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

HERE'S A NEW, BETTER METHOD OF ELECTRICAL DISTRIBUTION

N-E 100 AMP SPEEDBUS



"Speedbus," National Electric's new 100 amp busway, goes in so fast, and is priced so low that in most installations it actually is more economical to use than conduit or cable!

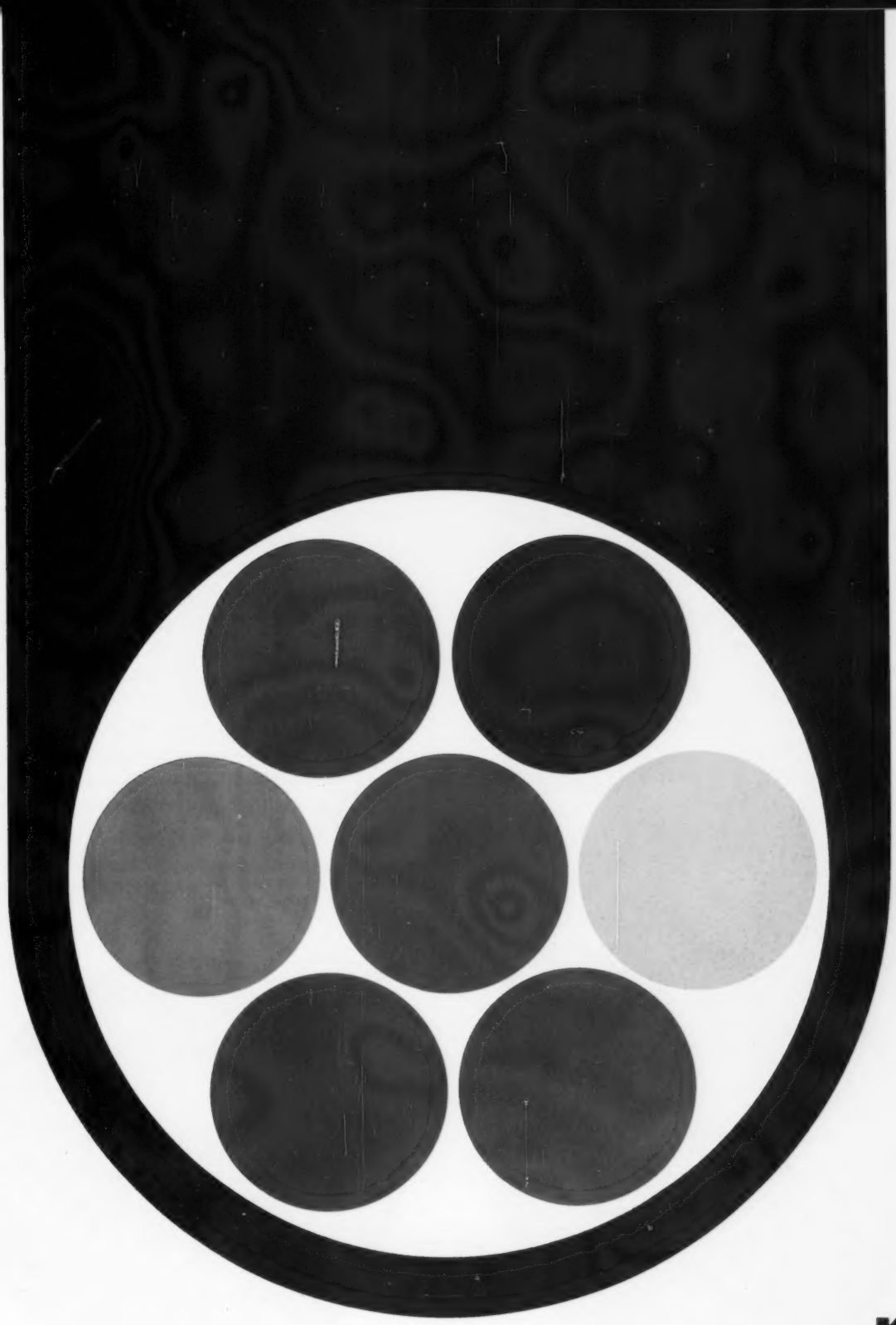
Never before has as compact and convenient a distribution system been made available. Never before has such wide application of busway been possible. In almost any commercial or industrial location where both power and lighting are required, this new, completely flexible, factory-assembled busway will serve best.

"Speedbus" can be plugged in from either side, back-to-back—16 usable outlets in every ten foot length. Bolted connections on case and conductor assure positive grounding continuity and electrical contact. Erection of "Speedbus" is simple—using only hand tools. Lightweight sections incorporating aluminum bus bars are easy to lift, and require fewer hangers.

For complete information on how to improve your electrical lighting or power distribution while saving money, call N-E Man, or write for literature. *National Electric Division, H. K. Porter Company, Inc., Porter Building, Pittsburgh 19, Pa.*

NATIONAL ELECTRIC DIVISION PORTER **H. K. PORTER COMPANY, INC.**

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.



IN ELECTRICAL WIRE & CABLE . . . **THE SPARK OF QUALITY IS KAISER WIRE EXPERIENCE**

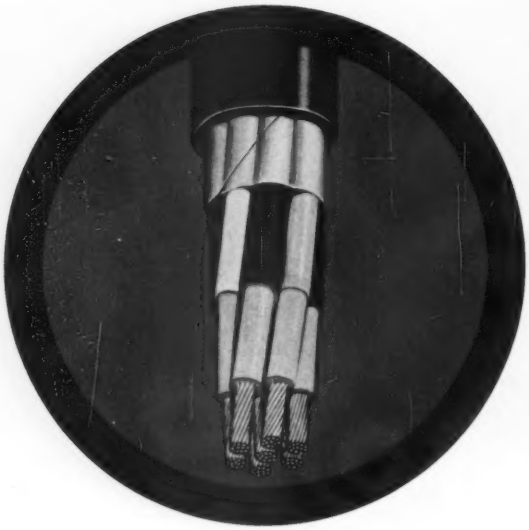
CONTROL CABLE... 28 YEARS OF PERFECT INSULATION SERVICE

KAISER MASTER LAYTEX® CONTROL CABLE has never known a reported insulation failure!...and the introduction of patented Laytex-Resin promises to improve upon this 28-year record of perfection!

Laytex-Resin is the combination of Laytex insulation with a specially-compounded resin layer over the insulation that eliminates the bulk of braided coverings. It brings the following advantages over extruded constructions:

Smaller diameter, to expand service without enlarging ducts...less weight...increased flexibility...proven greater insulation protection against acids, alkalies, flame, fungus, water, oil, ozone and light...uniform protection free of thin spots...can't wick moisture or fray...easier splicing...brighter color coding and longer lengths per reel.

SPECIFY 935-S. ASK FOR KAISER CONTROL CABLE BOOKLET.



POWER CABLE... 16.4 TIMES MORE OZONE RESISTANCE

KAISER GRIZZLY® POWER CABLE is the only power cable to resist 6000 hours of high ozone shock test—outlasting 9 leading brands tested!

Several samples of each unshielded 5KV cable were placed with a "U" bend resting on a grounded metal plate. A conductor-to-plate potential of 40,000 volts was applied until all cables failed. Four brands failed immediately. The last competitor gave out 432 hours before the first Kaiser cable. Kaiser Grizzly samples went on to last over 6000 hours . . . 16.4 times longer than the test average of best performances . . . 2.4 times the life of the nearest competitor.

The reason: A superior combination of Kaiser insulation and jacketing. In power cables it represents a major victory over the main cause of failure—dielectric breakdown due to ozone.

AVAILABLE IN A WIDE RANGE OF SIZES AND SPECIFICATIONS FOR OVERHEAD AND UNDERGROUND HIGH-VOLTAGE APPLICATIONS.

K/W EHV...1000 MILES OF 345KV...MUCH MORE IN THE FUTURE

KAISER ALUMINUM EHV CONDUCTORS span more than 1000 of the 2500 miles of extra high voltage transmission lines now in service in this country.

As system voltages of 345KV, 460KV and higher become more common, Kaiser offers specialized conductor design, manufacturing, and installation experience.

Kaiser engineers are actively engaged in utility experimental EHV installations...field measurements of corona loss as it affects radio and TV interference . . . bundled conductor and accessory analysis . . . problems of galloping conductors...vibration and tension studies . . . and other research toward better conductor design and installation.

As a result, standard paper expanded core conductors—as well as such designs as hollow core, "I" beam, and tubular expanded core—have been manufactured and subjected to torturous field installation procedures for evaluation.

IN ELECTRICAL WIRE & CABLE THE SPARK OF QUALITY IS K/W EXPERIENCE

The spark of quality means positive—often dramatic—savings in service for those who will specify Kaiser wire and cable.

Among the world's leading electrical wire and cable producers, only Kaiser is heir to the 70-year experience of a major rubber company in developing insulation and jacketing compounds.

Insulations such as Laytex®, Laytex-Resin, Hydrosec® and Kalzone give greater utility, longer life to a complete range of aluminum or copper conductors. For immediate service in any type of wire or cable, call your K/W Distributor or Kaiser Aluminum & Chemical Sales, Inc., Kaiser Center, 300 Lakeside Drive Oakland 12, California.

KAISER ALUMINUM

AN EXTRAORDINARY PUBLISHING ACHIEVEMENT OF OUR TIME!

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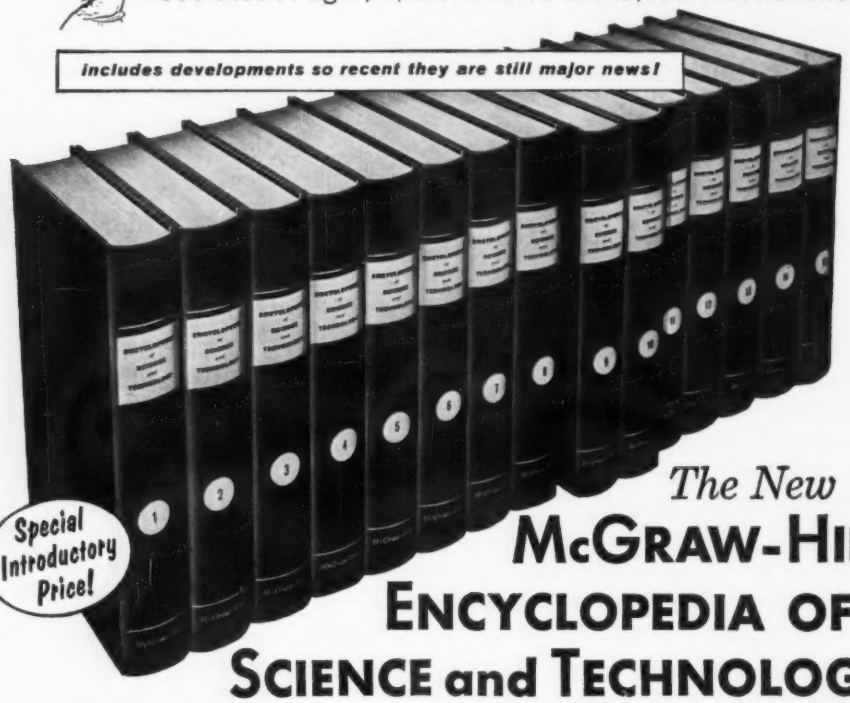
Includes developments so recent they are still major news!



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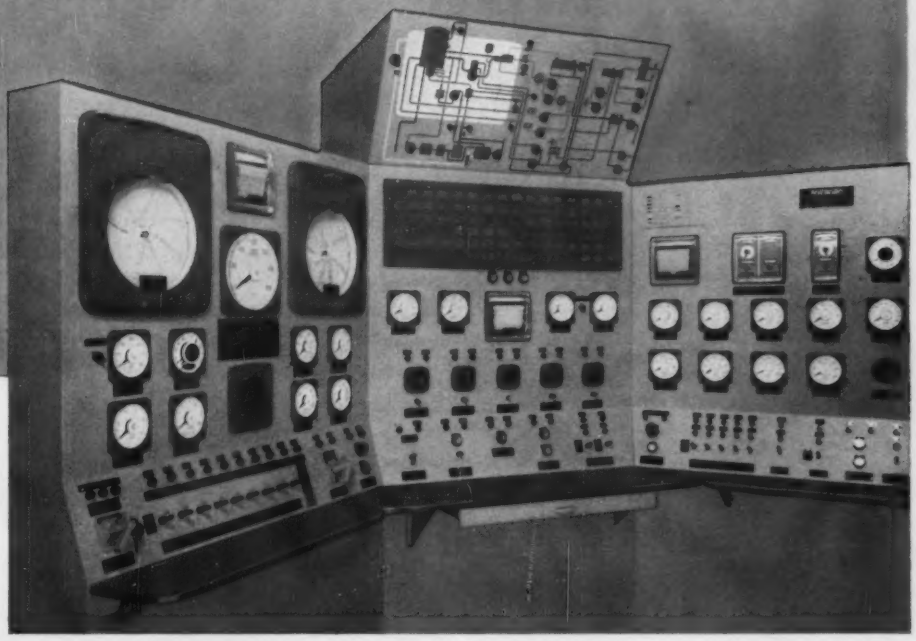
for Arctic nuclear power plant . . .

Foxboro electronic Consotrols to operate 24 feet under ice!



Instruments on Foxboro-designed Console indicate, record and control reactor temperatures, flow, steam generator level, pressures, conductivity, as well as computing Btu's. Pressurized-water type reactor was designed and built by Alco Products, Inc., Schenectady, N. Y., for the U. S. Army Corps of Engineers.

Snow-Millers are cutting tunnels to connect various facilities of Camp Century. Under-ice equipment will be fully protected from Arctic environment.

24 ft. deep tunnels are covered permanently with metal strips. Powdered snow, blown back over them, forms roof of tunnel.

Instrument reliability a must at this Army base in Greenland

A complete community, buried 24 ft. under the ice — this is the U. S. Army's Camp Century, now under construction on the Greenland icecap, 800 miles from the North Pole.

The Foxboro-instrumented nuclear power plant — built on 10 separate skids — will provide power for the remote base. Its core of uranium will produce a year's supply of steam and electricity before refueling.

For this installation, where reliability is so critical, dependable Foxboro electronic Consotrol* instruments were specified. 100% solid state — no vacuum tubes to replace — instantaneous response. Instruments have been performance-proved to operate down to —20F, and to withstand storage temperatures as low as — 50F. Foxboro console can be easily operated by one man.

Foxboro electronic Consotrol instruments are especially suited for nuclear power control systems. Ask your Foxboro Field Engineer to show you the reasons why. Or write for Bulletin 1-17A. The Foxboro Company, 248 Norfolk Street, Foxboro, Massachusetts.

Reg. U.S. Pat. Off.

FOXBORO

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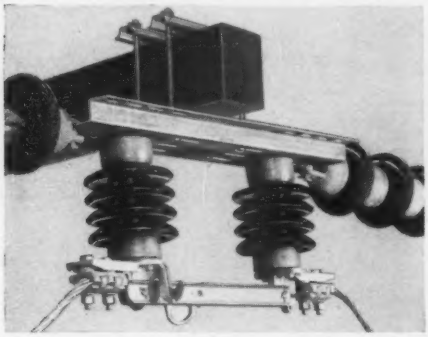
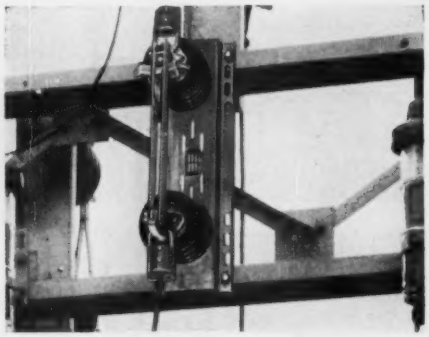
The New DS-DSB . . .
most adaptable switch of its type

I-T-E's new contribution to low-cost hook-operated switching

From base to blade, this rugged new switch provides unmatched adaptability to meet all of your specific requirements . . . at a new low cost. The DS-DSB makes no compromise with quality. Options in the selection of key components let you buy only as much switch as you need . . . nothing more, nothing less! It meets all NEMA electrical and mechanical requirements for hook-operated switching from 7.2 to 23 kv, 400 and 600 amperes. Check out this inexpensive "full performance" switch carefully and see for yourself!





The base is universal, providing double-crossarm mounting as shown on the facing page; or a rigid, double-bracket, single-arm mounting as shown at left above; or through-bolt mounting on steel (as shown at right above), or wood.

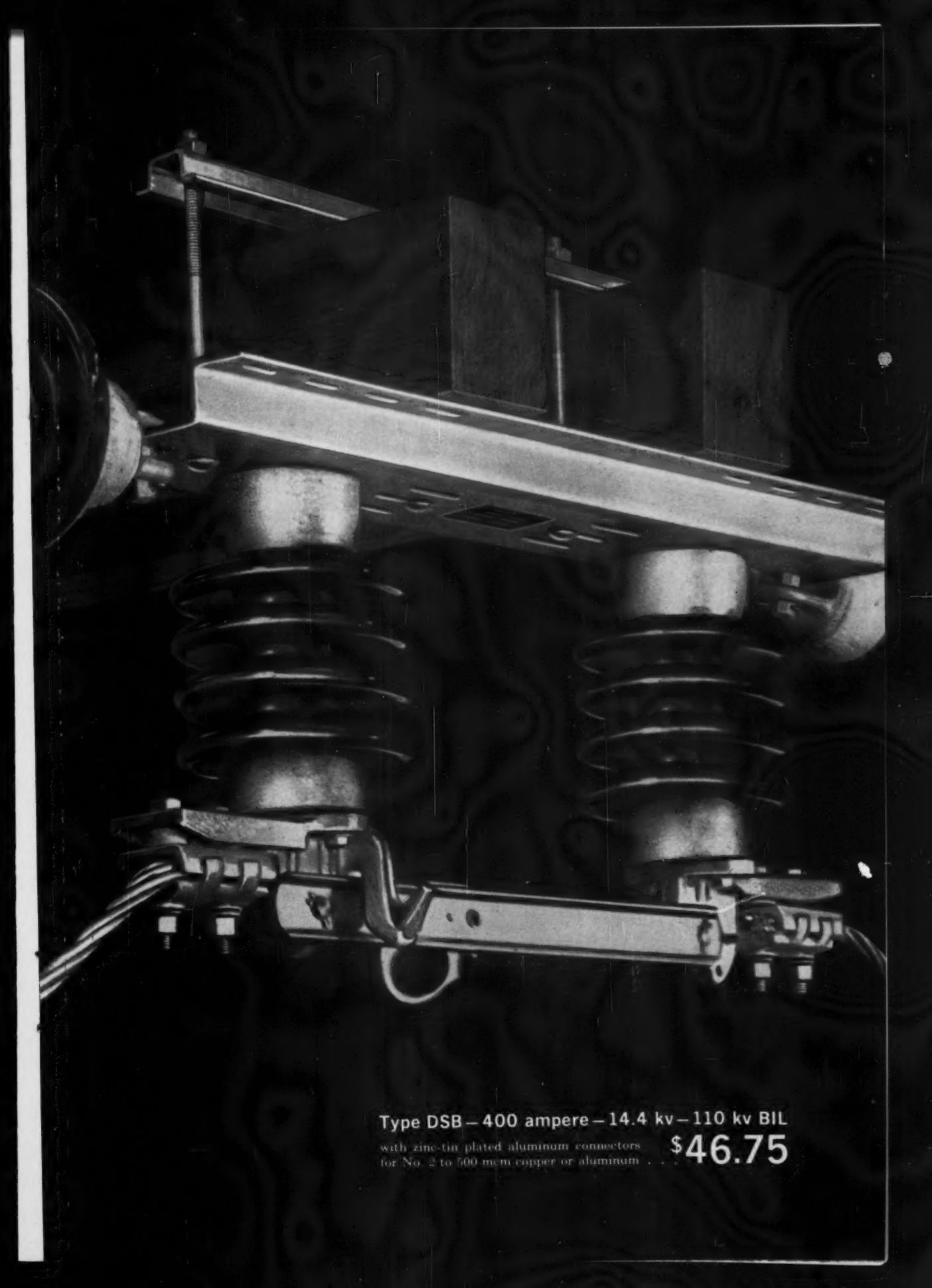
Loadbreak tool (S&C Loadbuster) operation is optional, with hooks to convert from DS to DSB shipped with each switch when specified.

The full line of these new, low-cost, Type D-insulated, NEMA rated switches are available from I-T-E warehouse stocks. All of the standard connectors, for aluminum and/or copper, are stocked with the switches.

IN ITS VOLTAGE AND CURRENT RANGE, THE DS OFFERS MAXIMUM VALUE AND PROVEN PERFORMANCE

Get complete information. Ask your local I-T-E representative for a demonstration, and a copy of Bulletin 1030A—or write for information to Greensburg Division, I-T-E Circuit Breaker Co., Greensburg, Pa.

I-T-E CIRCUIT BREAKER COMPANY



Type DSB – 400 ampere – 14.4 kv – 110 kv BIL

with zinc-tin plated aluminum connectors for No. 2 to 500 mcm copper or aluminum . . . **$46.75**

GOOD NEWS *in aluminum construction . . .*

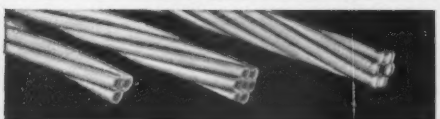
ALUMOWELD

Aluminum-Covered Steel Wire and Strand

Alumoweld was developed to cut costs and improve performance of overhead ground wire, ACSR conductors, guy and messenger strand. Its thick aluminum covering —25% by area—gives Alumoweld corrosion resistance equal to solid aluminum wire and 33% of the electrical conductivity.

When used as overhead ground wire, remember that Alumoweld is just as strong as steel, is 18% lighter in weight, and has 3 times the conductivity. These advantages permit greater mid-span clearance, and make Alumoweld excellent for relaying and for discharging lightning currents to ground. For guys and messengers, Alumoweld Strand provides the full strength of steel and will last far longer.

These valuable properties also pay off when Alumoweld is used as core wire for ACSR conductors. Here, Alumoweld eliminates the hazard of dissimilar metals in contact, provides increased conductivity and gives you an extra-high-strength core wire that matches the life of the solid aluminum wires. For the complete story, send for Bulletin E.D. 3000.



Two Exclusive features of **ALUMOWELD**

Alumoweld's thick aluminum covering will never crack, flake or peel. Applied by an entirely new cladding process—the controlled atomic weld —the heavy aluminum covering and the high-strength steel core are inseparably interlocked by a ductile weld that remains permanent under all operating conditions.

COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, GLASSPORT, PA.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

INDIAN POINT

Indian Point Station as it looked in April this year, showing some of the piping to be installed by Kellogg's Power Piping Division

NUCLEAR POWER PIPING BY KELLOGG

Construction progress at Consolidated Edison Company's Indian Point Station demonstrates how Kellogg's broad erection experience can take tomorrow's newest and toughest power piping requirements in stride.

At this unique 275 Mw nuclear steam electric generating station, Kellogg has a contract to manufacture, deliver, and to erect all stainless and carbon steel nuclear piping for the inside of the reactor sphere, and all power piping for the conventional portion of this plant. Kellogg also stress-analyzed the major portion of this piping. Much of the stainless piping will be manufactured in Kellogg's Williamsport plant.

The particularly rigid specifications of high quality and close tolerances required the assignment of a special engineering staff to the site. This staff plans, coordinates and supervises each step of Kellogg's erection assignment. One important phase entails over 2200 critical welds, most utilizing Kellogg's K-Weld technique. Another is the radiographic inspection of each weld, which Kellogg is undertaking with its own equipment and personnel.

Kellogg welcomes inquiries for its stress analysis, metallurgical, engineering, manufacturing and erection services.

POWER PIPING DIVISION • THE M. W. KELLOGG COMPANY

711 THIRD AVENUE, NEW YORK 17, N. Y. • A SUBSIDIARY OF PULLMAN INCORPORATED

Offices of Kellogg subsidiary companies are in Toronto, London, Paris, Rio de Janeiro, Caracas, Buenos Aires.

NOW 2,000,000 kva

CO_2 gas bomb—insures arc extinction on lowest faults

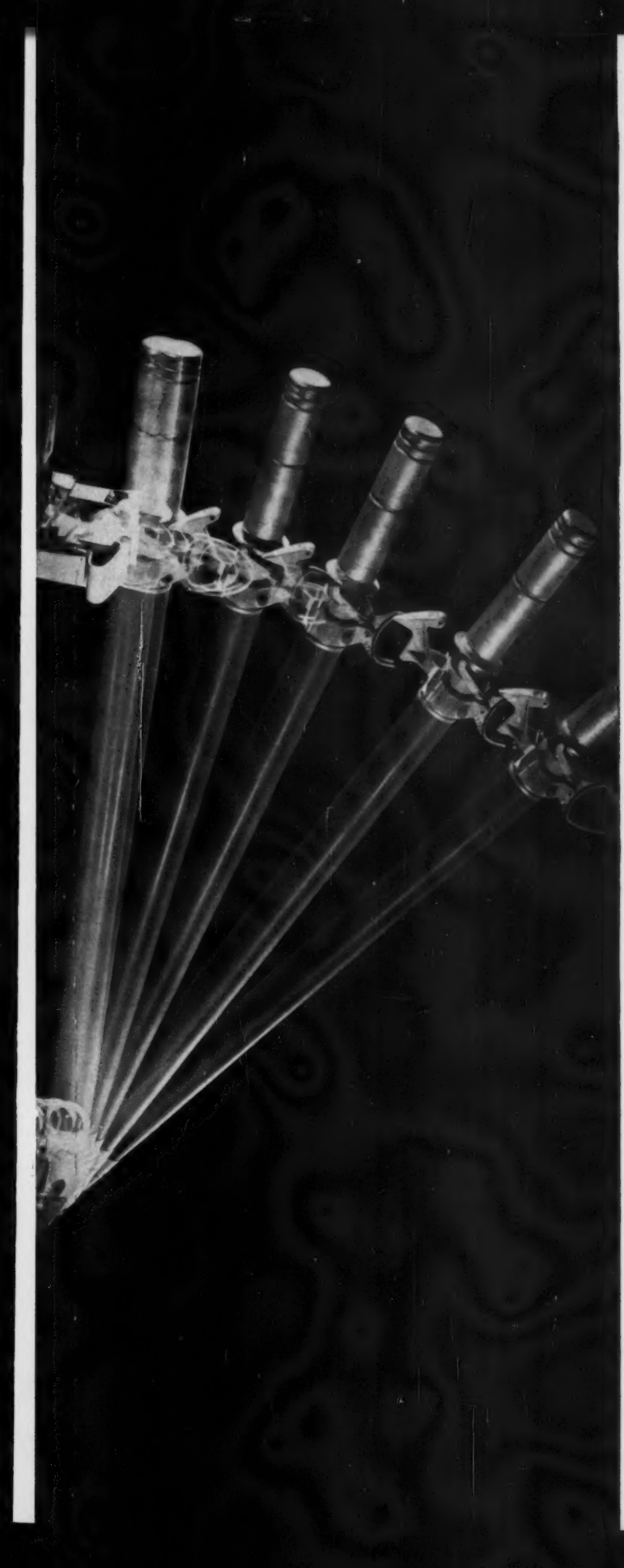
Fixed boric acid cakes—cemented to inner fibre liner—provide large bore for high faults

Expellable boric acid cakes provide minimum diameter bore for effective interruption of medium-to-low faults

Frangible retaining disc supports expellable boric acid cakes. The blast action of high faults ruptures the disc and expels the inner cakes. The resultant larger bore reduces internal pressures and exhaust gas velocities

Fusible element—nondamageable construction

SMD—2B FUSE UNIT



100% higher interrupting ratings for S&C Power Fuses... and confirmed by test

This new performance level means you can now use power fuses on power transformers tapped onto transmission and subtransmission lines—even where faults may run as high as 2,000,000 kva. Now you can have power fuse protection of small-to-medium transformers in even more places on your system. You have more opportunities to get the benefits of S&C Power Fuses: low-cost, maintenance-free protection against primary and secondary faults, without momentary interruptions on the line.

All this is made possible by S&C's new SMD-2B Power Fuse, which uses a new principle in boric acid circuit interruption, explained on the opposite page.

Behind these new ratings* is a three-year program of laboratory and field testing, culminating in the heaviest faults ever deliberately applied to a power fuse. At the KEMA laboratories at Arnhem, the Netherlands, a power fuse (S&C's SMD-2B) for the first time successfully and repeatedly cleared line-to-line faults of 2,000,000 kva magnitude.

For complete information, write for Descriptive Bulletin 261.

*New ratings established by test

Voltage Rating	Interrupting Rating, Kva 3-Phase Symmetrical	
Kv	New	Old
34.5	1,500,000	1,250,000
46	1,750,000	1,250,000
69	2,000,000	1,500,000
115	2,000,000	1,000,000
138	2,000,000	1,000,000

S & C ELECTRIC COMPANY

4421 Ravenswood Avenue • Chicago 40, Illinois

Specialists in High Voltage Circuit Interruption since 1911

S&C

POWER TRANSFORMER SOUND REDUCTION THROUGH PROPER APPLICATION OF A SPECIAL NEW CORE STEEL

Improved power transformer cores having a marked reduction in the sound energy generated are now available as a result of a basic development program directed at the source of sound as contrasted to the suppression of sound

by

C. M. LOVELL,

Vice-President in Charge of Engineering and Research

Introduction

Many important steps have been taken by the transformer manufacturers in recent years to reduce power transformer sound; but in some areas, the electric utilities' transformer sound problem has continued to grow. A big factor in the growth of this problem is the increased public sensitivity to transformer sound. While this may be absurdly acute in some cases, the fact of a growing and serious public reaction makes the problem of sound of major concern to the electric utilities.

Moloney Electric Company is conducting several developmental programs to obtain practical and economical methods of alleviating the utilities' transformer sound problem. The particular program discussed here is a basic development program aimed at reducing sound levels by attacking the problem at its source through the proper application of a new core steel.

SOURCE OF SOUND

Sound energy is generated in the power transformer core by magnetostriction—a pulsating change in length of the core steel when carrying alternating flux. While some additional sound energy is generated by pulsating attraction forces within the core, this sound can be readily minimized by skillful core design and manufacture.

The sound energy thus generated by magnetostriction in the core is transmitted mechanically to the tank and outer accessories of the transformer—from there to the surrounding area.

APPROACH TO SOUND REDUCTION

There are obviously two main channels of attack on sound—

MOLONEY ELECTRIC COMPANY

Since 1896 . . . MORE POWER TO YOU . . . WITH

(a) Reduction of the amount of sound energy emanated from the transformer by using suppressive means.

(b) Reduction of the amount of sound energy generated at the source—that is, in the core.

A great deal of work has been done by the transformer manufacturers in the development of various means of suppressing sound. In those cases, however, where substantial and consistent reductions are achieved—such as with double tanks—the degree of cost increase is high. Also, the weight, dimensions, and complexity of the transformer are substantially increased. With lesser suppressive means—such as resilient supporting pads—the sound reductions achieved tend to be marginal and inconsistent.

These results indicate that reduction of the sound energy generated at the source is a more positive approach to the problem than the use of suppressive means.

NEW SPECIAL TYPE OF STEEL

In response to a request by the Moloney Electric Company, the Allegheny Ludlum Steel Corporation has developed and made available a special low magnetostriction steel known as "SILECTCOR".

This special steel is stress free, exceptionally flat, and has a remarkably low magnetostriction characteristic. Basic watt loss or permeability remain the same as for conventional cold-rolled oriented steel.

APPLICATION OF THE SPECIAL NEW STEEL

To properly apply SILECTCOR to power transformers on a production line basis it was necessary that new core design and manufacturing techniques be developed. Without these new techniques, the superior qualities of the special steel would not be reflected in improved core performance.

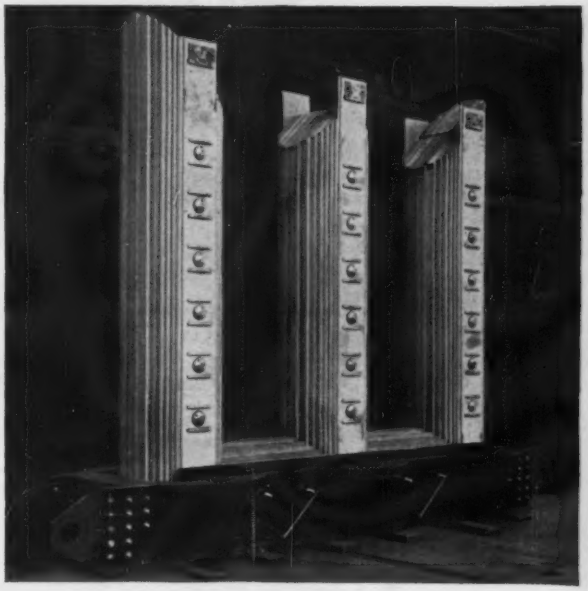
The new core design and manufacturing techniques necessary were developed by Moloney Electric Company after an extended research program to determine the design and production procedures that would result in the lowest sound levels at a reasonable cost.

To date, these new techniques and the special steel have been successfully applied by Moloney Electric Company to approximately 150 power transformers ranging in capacity from 500 KVA to 217,000 KVA. It is planned to steadily increase the application of this new steel to Moloney power transformer production.

RESULTS ACHIEVED

Other factors the same, average reductions of approximately 8 decibels in sound level are consistently attainable as a direct result of the proper application of SILECTCOR to the larger sizes of power transformers. The reductions decrease gradually to approximately 4 decibels for the smaller sizes.

It is significant that these sound level reductions are attainable for a reasonable manufacturing cost increase and without increasing weight, dimensions, or complexity of the transformer.



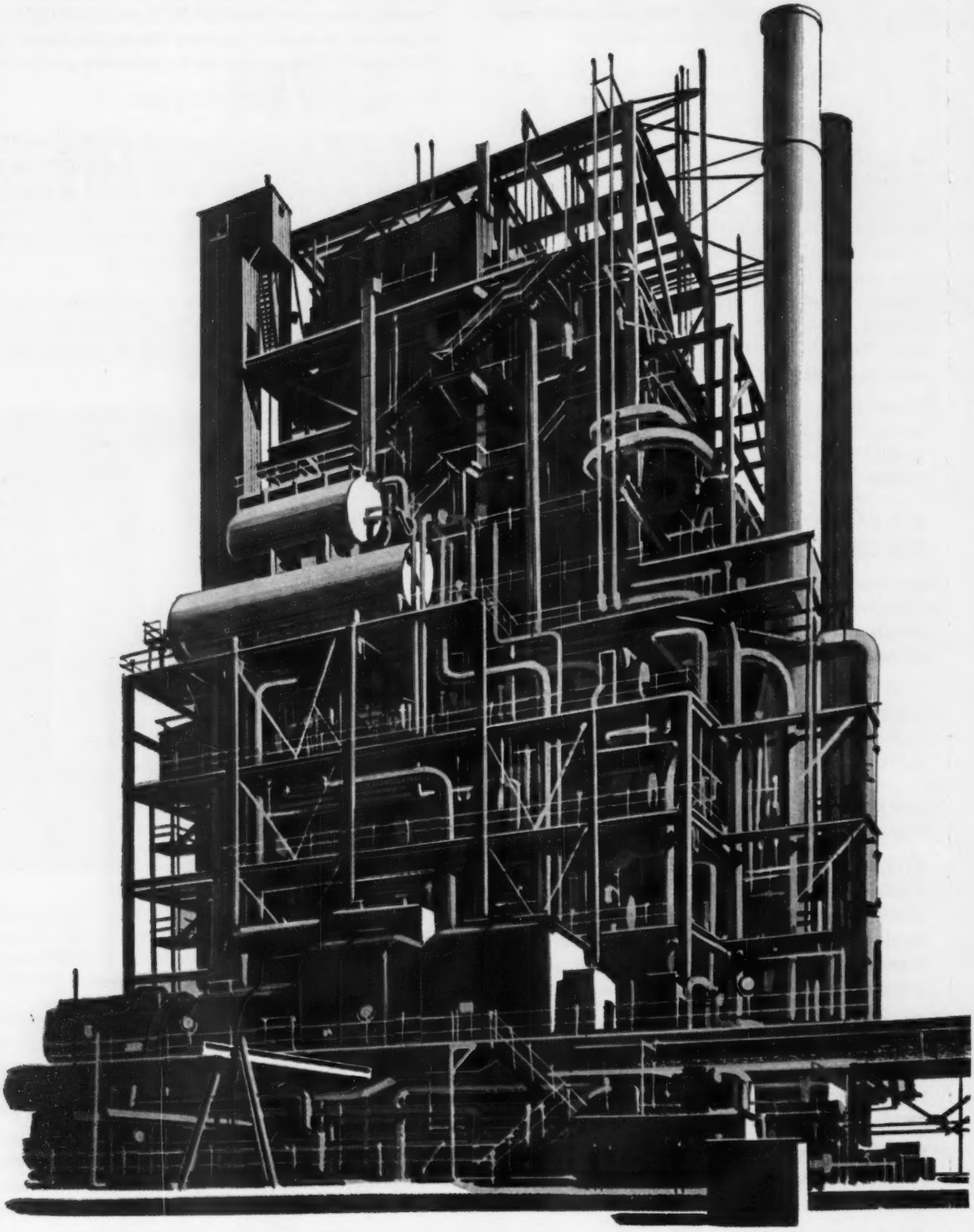
Cores built with SILECTCOR are remarkably straight as illustrated. This straightness minimizes clamping stress concentration and thus leads to side benefits of reduced core loss and exciting current.

The program is a good example of the positive value to the electric utilities of the constructive research and development being carried on in the manufacturing industry. Moloney Electric Company is conducting continuous research and development programs both in cooperation with customers and suppliers, and independently, to find better answers to the transformation problems facing the industry.

ME-60-22

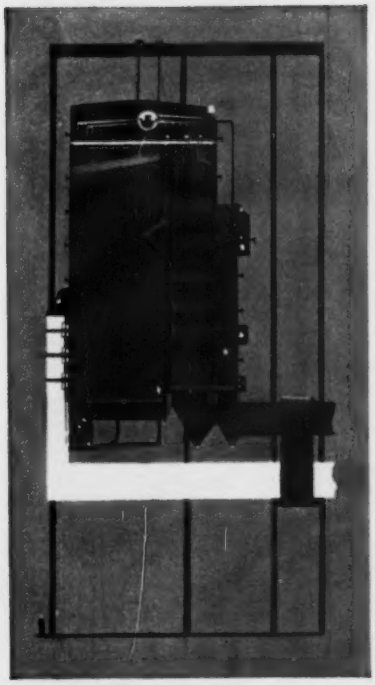
FACTORIES: ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

TRANSFORMERS FOR UTILITIES • INDUSTRY • ELECTRONIC APPLICATIONS



POWER PLANT PRODUCTS HEAT ENGINEERED BY FOSTER WHEELER:

Central Station and Industrial Steam Generators • Steam Condensers and Pumps • Pulverized Fuel Systems • Feedwater Heaters • Packaged Steam Generators • Cooling Towers • Nuclear Components

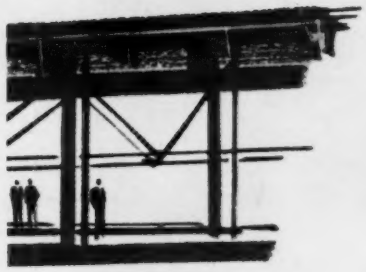


A word about steam generators

In this age of miracles some forthright words have been mislaid.

One is *thoroughness.*

Thoroughness is as much a product of our company as steam generators. By *thoroughness* we mean "careful attention to detail"—not some of the time but all of the time.



What does this mean to you? It means you save money on operations, keep your maintenance staff to a safe minimum, and prevent costly power interruptions.

Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N.Y.

FOSTER WHEELER

NEW YORK LONDON PARIS ST. CATHARINES, ONT.

NO MORE ENGINE IDLING

. . . with NEW MOTOROLA MOTRAC* 2-way radio

Idle a truck engine 4 hours a day—to regenerate for battery drain due to 2-way radio—and you waste *more than a hundred dollars* a year in gasoline alone! Add the cost of engine wear, replacement batteries, generators, etc., and you've got a significant cost leak.
But now it's *unnecessary*. Motorola MOTRAC radio uses only a trickle of current—less than a dome light—so engine idling is *out*. And that's just the *start* of MOTRAC radio savings. Truly advanced design and rugged construction give you greater *reliability*, and much longer life.
Here is truly dependable equipment for long-run economy.
It's a big story. Get all the facts about this outstanding new radio. Call or write today.

HERE'S THE INSIDE STORY—Commonest source of maintenance problems—vibrators and receiver tubes—have been replaced by dependable transistors. MOTRAC radio can be used with any 6 or 12 volt vehicle—positive or negative ground. Models available with up to 100 watts power output.

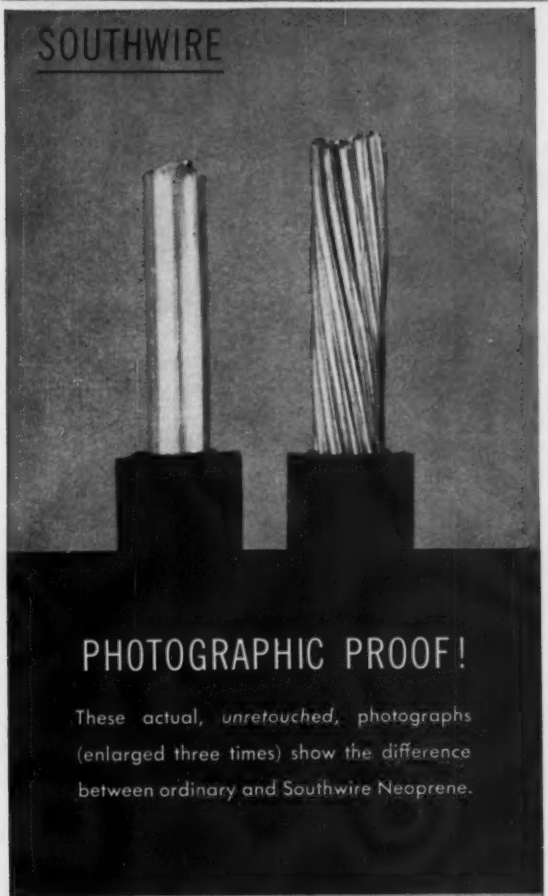
MOTOROLA 2-WAY RADIO

Motorola Communications & Electronics, Inc., 4501 Augusta Blvd., Chicago 51, Ill. A Subsidiary of Motorola Inc.

**MOTRAC is a trademark of Motorola Inc.*

100% FREE STRIPPING

100% OF THE TIME!


SOUTHWIRE
PHOTOGRAPHIC PROOF!
These actual, *unretouched*, photographs (enlarged three times) show the difference between ordinary and Southwire Neoprene.
ORDINARY

SOUTHWIRE

NEOPRENE COVERED COPPER

Get what you pay for when you order free stripping Neoprene Covered Copper Wire and cable—not just some of the time, but every time!

Southwire's compounding and extruding techniques, developed only after long and exhaustive testing, are your guarantee of premium quality—and long, trouble-free conductor performance.

Southwire Neoprene is consistently 100% free stripping. It will not stick—even to stranded wire. It will not discolor the copper. Wires need no scraping before connections are made.

And there is no premium in price for this superior product—another Southwire first!

- **NO STICKING – NO DISCOLORATION**
- **NO SCRAPING NEEDED FOR CONNECTIONS**
- **NO PREMIUM IN PRICE**

FREE SAMPLES AND TECHNICAL DATA ON REQUEST

SOUTHWIRE serves the world

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories
- NM Sheathed Cable
- ALSO FABRICATORS OF COPPER AND ALUMINUM FOR WIRE AND CABLE MANUFACTURERS

Southwire Company

TErrace 2-6311 CARROLLTON, GEORGIA

For fuses with 200,000 ampere interrupting capacity...

***plus,* extreme current-limitation**

plus,* time-lag to prevent needless blows – *you need...

Buss LOW-PEAK fuses

A Revolutionary New Protective Device

Buss LOW-PEAK Fuses are designed to meet modern demands for electrical protection.

They safely interrupt fault currents up to 200,000 amperes . . . limit let-thru current to exceptionally low values . . . and hold 500% load for minimum of ten seconds.

Protect Mains, Feeders, Branch Circuits, Motors, Controllers, Switches—no matter whether the fault current is 1,000 amperes, 25,000, 100,000—or as high as 200,000 amperes.

Reduce stresses and prevent damage to Panelboards, Switches, Motor Controllers—other circuit components—because let-thru fault currents are limited to exceptionally low values.

Can be easily co-ordinated into a selective system—to limit fault outages to circuit of origin.

Prevent work stoppages, lights out, waste of time and money—because long time-lag keeps them from opening needlessly on motor starting currents or other harmless overloads.

Permit increasing interrupting capacity and current limitation on present electrical system at minimum cost. Buss LOW-PEAK Fuses fit standard switches and panelboards. Available from 15 to 600 amperes in both 250 and 600 volt ranges.

Guard motors against burnout from single phasing and overloads.

Low operating temperature reduces heating in switches and panels.

Provide thermal protection for equipment against damage due to poor contact.

Protect against waste of space and money by permitting the use of proper size switches and panels.

Remain safe throughout the years without maintenance or recalibration.

▼

Write for Buss LOW-PEAK Bulletin Now . . . or use coupon.

BUSSMANN MFG. DIVISION,
McGraw-Edison Co.
St. Louis 7, Mo.

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Bussmann Mfg. Division, McGraw-Edison Co.
University at Jefferson, St. Louis 7, Mo.
Please send Buss LOW-PEAK Fuse Bulletin LPCS.

Name.....

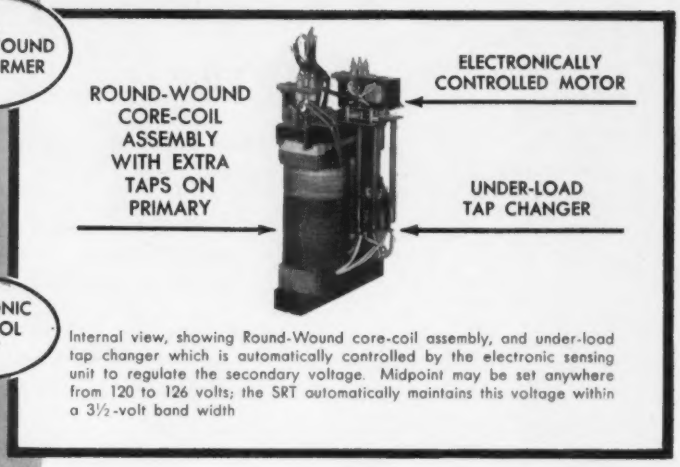
Title .....

Company.....

Address.....City.....State.....

EW-860

SRT simply replaces conventional transformer where you have a regulation problem. It requires no extra pole space, no additional wiring. Note the new electronic unit—mounted externally where it is not affected by oil temperature changes, and is easily accessible for changing midpoint settings if desired.



Internal view, showing Round-Wound core-coil assembly, and under-load tap changer which is automatically controlled by the electronic sensing unit to regulate the secondary voltage. Midpoint may be set anywhere from 120 to 126 volts; the SRT automatically maintains this voltage within a 3½-volt band width

L-M's Electronic SRT®

Now in Full Production For Immediate Delivery

L-M's exclusive Self-Regulating Distribution Transformer fully tested in actual service for two years. Now new electronic control on the SRT® offers greater flexibility in the field, easier accessibility, longer expected life.

The Self-Regulating Transformer, developed by Line Material and put on the market in limited quantities two years ago, has been highly successful. By regulating right at the point of use, the SRT can solve both low-voltage and over-voltage problems and can provide better service for utility customers. Thus it greatly reduces customer complaints caused by voltage variations. Under most conditions, the SRT is the most economical means of voltage correction. In addition, extensive utility tests have proved the SRT reliable and efficient.

How the SRT Operates

The SRT requires no additional pole space, no extra wiring. Instead, the SRT contains, in one tank, a distribution transformer with extra taps on the primary, a regulating mechanism that is volt-sensitive on the secondary, and an automatically operated under-load tap changer on the primary. As secondary load fluctuates, the tap changer switches primary turns in or out to keep secondary voltage within a 3½-volt band width around a predetermined 120 to 126 volt midpoint.

Now With New, Field Tested Electronic Control

The SRT was originally equipped with a hydraulic operating unit that proved extremely dependable and accurate. Further work by L-M research engineers has resulted in an electronic solid state control that thorough field testing shows is not only exceedingly accurate, but also completely flexible. It may be adjusted to any desired mid-point voltage while the transformer is operating without the use of instruments.

Since the electronic unit is external to the tank, its components, therefore, are not affected by high oil temperatures associated with transformer loading. In addition, the total absence of moving parts assures life expectancy comparable to that of the transformer without need for periodic inspection.

Get Complete Details on SRT

Ask your L-M Field Engineer to show you reports from utility companies having extensive experience with the SRT, and details on its operation and application. Or write Line Material Industries, Milwaukee 1, Wisconsin.

YOU BE THE JUDGE OF SRT VALUE

Ask the L-M Field Engineer to present the evidence of value of the cool-running Round-Wound® Transformer, and the great new Electronic control. Then you be *the judge!*

LINE MATERIAL® Industries
McGRAW-EDISON COMPANY

Distribution Transformers

McGRAW EDISON

478

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Editorial Comment

AUGUST 15, 1960

Danger Signals Fly on Pooling and Interconnections

A sizable batch of system development plans for non-investor-dominated pools and interconnections has been developing over the past year. Recently, news reports have indicated stepped-up activity (see p 22).

It is clear to us that a real pattern is developing. It is no coincidence that it is developing just before a national election. Virtually every plan calls for, or can be expected to call for, heavy federal transmission.

The danger signals given by these activities, by demands for nationwide federal power grids, and by the wording of the Democratic Party natural resources plank (EW, Aug. 8, p 32) should be unmistakable to all.

The investor-owned utility industry has diligently, if reluctantly, presented the job it has done on interconnections and pooling, and the general projection of how it will keep the "program" going.

Unfortunately, this is not enough. Strengthening of pools, creation of new pools, and the pooling of pools should be basic industry policy. Work on it at national and company levels should be unflagging. Each utility should be reviewing, planning, and cooperating actively with investor and non-investor neighbors and near-neighbors, toward the utmost interconnection and integration possible.

Objections raised on points of aversion to FPC jurisdiction, or on financing difficulties, should not be allowed without close, objective scrutiny as to their basic validity.

Will history repeat on the theme of the federal government doing a needed job because industry refused or feared to undertake it?

Too Preoccupied With Product?

The lead article in the July-August issue of the *Harvard Business Review*, if read from the viewpoint of the electrical utility or of the electrical equipment manufacturer, strikes home with startling clarity.

"Marketing Myopia," by Theodore Levitt, is "must" reading for people in our business. It is a thoughtful yet scathing analysis of the inclination of product-conscious "growth industries" to neglect needs and desires of their customers.

Mr. Levitt laces his brew with case histories of faltering industries and companies which have been convinced that there is no substitute for their product. Titillated by prospects of a burgeoning and richer population, they were mesmerized by the rapidly declining unit costs of mass production.

Each was preoccupied with a product that "lends itself to carefully controlled scientific experimentation, improvement and manufacturing cost reduction."

The author gets into the semantics of the terms "marketing" and "selling," but goes much further. "Marketing," to him, concentrates on satisfying the needs of the customer *by means* of the product. "Selling," he says, "is preoccupied with the seller's need to convert his product into cash."

The author says we honor Henry Ford incorrectly for his *production* genius. Actually, he was a *marketing* genius who created mass production because of the public's desire for low-price cars. Though Ford emphasized this, "a nation of production-oriented business managers refuses to hear the great lesson he has taught."

Do the electrical utility and electrical equipment industries "market" or "sell?" Both precisely meet Mr Levitt's specifications for industries likely to meet trouble.

They are product-oriented instead of customer-oriented.

Mr Levitt's preoccupation with his own subject has let several errors creep in. They should not be allowed to detract from his fundamental approach.

We cannot over emphasize our recommendation that Mr Levitt's article be read. Try the shoe on your own foot, and if it fits, put it on.

UNION LEADER William H. James, second from right, gets court order prohibiting further striking from deputy sheriff

ROBERT A. OLSEN, right, KCP&L president studies seizure proclamation with state mediator D. C. Rogers

KCP&L Linemen Bow to Court Order

Union defies seizure and court order for five hours, then returns to work, vowing test of law's constitutionality.

A month-old strike at Kansas City Power & Light Co settled into a temporary lull last week as striking linemen and outside workers returned to work under a seizure edict by the governor and the threat of heavy fines by the courts. Local 1464 of the International Brotherhood of Electrical Workers had defied the governor and the circuit court for five hours before removing pickets who had also kept members of two other locals from returning to work. The local has threatened to take its case to court to test the constitutionality of the King-Thompson Law under which the governor seized the struck union.

During the six-hour fracas, Kansas City hit a new all-time peak as a 97F temperature and heavy use of air conditioners pushed total demand to 811,000 kw at 2:02 pm. But 300 supervisory employees kept the system operating without interruption throughout the day.

The union's act of defiance came after Missouri Governor James T. Blair seized Kansas City Power & Light at noon, Friday, August 5, under a state act empowering the governor to seize any struck utility if the public welfare is in jeopardy. It has been invoked seven times since its passage, the last time in a similar dispute between KCP&L and Local 1464. At 1:30 the same afternoon, the state obtained a temporary restraining order, prohibiting further striking, from the Jackson County Circuit Court. The court set a hearing for Aug. 24 for the union to show cause why the order should not be permanent.

Shortly after 8:00 pm, William H. James, business agent of Local 1464, announced that pickets were being removed from company property in Missouri and Kansas, including offices and power plants in Kansas City, Mo., and Montrose, Mo., and a warehouse in Johnson County, Kansas. He commented that, "On the advice of our lawyers, we are complying with the order of the circuit court. We are going ahead with our plans to test the constitutionality of the King-Thompson Law, but our men will go back to work."

Normal Operations Resumed

Normal shifts resumed work Saturday morning at three power plants. In the metropolitan area, 16 crews began overtime work extending lines to 600 new homes which had been without power since the strike began. Two crews were replacing transformers which be-

Utility Strike Law Has Big Teeth

Missouri's King-Thompson Law provides that any union violating the provision against concerted refusals to work can be fined $10,000 per day for each day of work stoppage after the refusal to return to work. A fine of $1,000 is provided for union officers violating this provision.

One section of the law reads, "It shall be unlawful for any person, employee, or representative as defined in this chapter to call, incite, support, or participate in any strike or concerted refusal to work for any utility or for the state after any plant, equipment, has been taken over by the state under this chapter, as a means of enforcing any demands against the utility or the state."

Another section of the law states that, "The courts of this state shall have the power to enforce by injunction or other legal and equitable remedies any provision of this chapter or any rule or regulation prescribed by the governor hereunder."

came overloaded during the strike.

Comenting on the governor's action, State Mediation Board Chairman Daniel C. Rogers said, "There was no question but that we were facing a serious situation when the governor acted. We had gone for more than three weeks without hundreds of regular production and outside maintenance workers."

"A total of 300 supervisory employees, less than one-fifth of the employees of the company, had been in the generating stations without leaving their posts." Supervisors have eaten and slept in their buildings and had virtually no contact with their families.

Storm Possibility Feared

"It is only by a fortunate set of circumstances that we have not had any severe windstorms or electrical storms which could have knocked down lines and blown out transformers," Rogers said. "The governor felt this luck could not go on forever." He said the company could not have restored power in event of a disaster as long as the linemen were on strike.

In the meantime, Rogers said he doubted that further mediation sessions could be held until week-long "cooling-off" period had passed.

James had threatened to defy the seizure when the governor announced his intent to seize the previous day. When two county deputy sheriffs served him with the court's restraining order, he shouted, "To hell with them, we're going to ignore it!" James said he was willing to go to jail if necessary, because of his beliefs with regard to the strike and the King-Thompson Law. James denied that the union had forced Gov Blair to invoke the law in order to test its constitutionality. He claimed 300 members of the local had voted to defy the order.

Initial causes of the strike were disagreements over a new contract, to replace one that expired June 30. Two other groups of employees, Local 1613, representing clerical workers, and Local 412, generating station workers, reached contract agreements the previous week, but still refused to cross the linemen's picket lines. In all, about 1,700 employees have been off their jobs since July 12.

The linemen have demanded that KCP&L negotiate: (1) The work week and work day of all job classifications, (2) Any changes in job classifications, and (3) Any modifications of safety regulations in the contract. They also demanded that the company submit to arbitration any of these subjects if the utility and the union cannot agree on them. The utility maintains these decisions are the prerogatives of management.

However, two days before the seizure, in a compromise move, the utility agreed to notify the union in writing of any proposed changes in job classification, negotiate those which the union does not approve, and delay them for 60 days while negotiations are in progress. It also offered to submit in writing any proposed changes in safety regulations to which the union objected to an outside electrical consulting firm familiar with the industry and to be bound by the findings of this firm. The union apparently refused to accept these terms.

According to Philip C. Metzger, KCP&L vice president, the union countered with a stiffer wage demand it had earlier abandoned. He said, "They told us they were now asking for a 5% increase in wages and benefits. They had indicated earlier that they might be willing to accept 4.5% if other concessions were made. Now they have indicated they want both."

With the company operating under the seizure order, negotiations are expected to be resumed shortly between the utility and the union. Rogers opined that final resolution of the dispute would not come until there was a new contract.

As the union attempted to push its case into court, Federal Judge R. M. Duncan told the union lawyer that a Federal Court in Kansas City would have no jurisdiction to issue an injunction or restraining order prohibiting the state from applying the King-Thompson Law under a challenge of the constitutionality of a state law. He said the chief judge of the Eighth Federal Circuit in Omaha would have to appoint a three-man panel to head such a matter. The union attorney did not file a complaint at that time, but is expected to.

FPC Boosts 1980 Peak Power Estimate

The nation's anticipated 1980 peak power demands will hit about 380 million kw, predicts the Federal Power Commission. And about 437 million kw of installed capacity will be needed by utilities to meet the demand.

Utilities' 1980 energy requirements will hit 2,083,590,000, the FPC also estimates.

This is the fourth prediction—the third upward revision—on the 1980 power situation made by the Commission since 1956. Each estimate has been higher. A 1956 prediction said 1980 peak demand would be 335 million kw, needed capacity would be about 384 million kw; the 1958 FPC revision predicted a 343-million kw peak, 394 million kw for capacity; a 1959 estimate foresaw a 366-million kw peak and a necessary 421 million kw in utility capacity.

Most of the increase in this latest prediction comes from a 6-million kw hike in the peak expected for the northeast (FPC Region 1), and a 4-million kw rise in the estimates for the Southwest (FPC Region 5). Most of the Northeast increase is due to expected higher use patterns following construction of the St. Lawrence and Niagara Power Projects. The Southwest's rise is due to a higher growth rate than previously predicted.

Hawaii, Alaska Unmentioned

The new FPC predictions do not cover Hawaii or Alaska, nor do they predict nuclear power capacity "because of the many uncertainties involved at this stage of development . . ."

Needed capacity in 1980 is predicted by the FPC as follows: total US, 467 million kw (steam, 390.4 million kw; hydro, 68.7 million kw; internal combustion, 7.9 million kw); utility capacity, 437 million kw (steam, 364 million kw; hydro, 68 million kw; internal combustion, 5 million kw); industrial capacity, 30 million kw (steam, 26.4 million kw; hydro, 700,000 kw; internal combustion, 2.9 million kw).

US and Canada Continue Talks

Closed sessions prevent knowing whether there is progress or just more proposals being considered by negotiators

Negotiators are playing their cards so closely that it is difficult to know what progress, if any, is being made in talks between the United States and Canada on joint development of the Columbia River.

Electrical World reporters in Washington, D.C., Victoria, B.C., and Ottawa have uncovered some indications that one major point of disagreement is coming out of a US attempt to place a time limit on the 50-50 split on downstream benefits. The US proposal is said to be that payments to Canada for increased benefits would be gradually reduced over a period of 40 years and then end.

Apparently Canada had understood that added kilowatts produced at US dams would be shared equally in perpetuity, with the US wheeling power to the border at no cost to Canada. Instead, the US proposes the diminishing export of power, and that wheeling costs would be given a dollar value which would be subtracted from kilowatt exports.

Disagreements between the Canadian and British Columbia governments, which have stalled negotiations at times, have been resolved, according to Ray Williston, B.C. lands and forests minister. He declined to elaborate on his statement.

Basic differences between the provincial and federal governments were centered around the sequence of development of projects in Canada. B.C. was planning in terms of a provincial plan for the Columbia, posssibly tying to the Peace River development, and the federal government was thinking in terms of an international plan for the entire Columbia Basin.

Williston threw some light on what the basis of agreement might have been when he said that Mica Creek Dam will be built no matter what other projects are agreed upon. He said every government and every engineering study has affirmed the best single development on the Columbia is the Mica installation. "The only point of argument must be as to whether the additional water required by the US is to be stored in Arrow Lakes or in East Kootenay," he commented. Up to now the B.C. government has favored Arrow Lakes because it compliments the Peace River Project, according to critics favoring the federal government's East Kootenay preference. They also say Arrow Lakes development first would seriously impair economic justification of Mica Creek. Williston's statement, then, indicates agreement might be along the line of simultaneous building of Mica and Arrow Lakes Dams.

If this conjecture proves to be true, the plans of Peace River Development Co for a Peace-Columbia joint development would fall by the wayside, since the federal government ignores the Peace River proposal. It still stands, however, as a lever for Canada's use in the international talks with the US. Canada would be able to talk in terms of allowing the Peace River development and postponing work on the Columbia. The effect of this would be beneficial to British Columbia almost immediately, but would cost Canada long-range benefits available from an agreement with the US.

Williston told *Electrical World* that the B.C. government's policy on Columbia River development in Canada, as far as actual construction is concerned, is that it would be done by the British Columbia Power Commission. Peace River development is proposed by a private company and depends largely on a giant power pool, perhaps including the US Pacific Northwest, for its economic feasibility.

Another long delay in negotiations would come out of B.C. insistance that the Peace-Columbia proposal on an international basis still be considered.

New Tax Law for Utilities Considered

Proposed legislation which would tax all electric utilities on the same basis is being drafted by a subcommittee of the Washington State Legislature. The proposals being drawn up by the subcommittee on revenue and taxation of the State Legislative Council—an interim agency of the legislature—would exempt REA's and private utilities from the property tax. Energy sales of municipals, REA's and private companies would be taxed 5%, with the proceeds going to county governments.

Before the proposals can be submitted to the legislature, they must be approved by the full subcommittee and the Council. Cities in the state are already objecting to the proposals, while counties, port districts, and school districts are generally favorable.

Strongest opposition is expected to come from the cities of Seattle, Blaine, Ellensburg, Tacoma, Cashmere, and Port Angeles, which get substantial revenue from municipal utilities. Tacoma estimates that the new tax formula would cost its general fund up to $800,000 a year.

The proposed bill would allow cities to impose their own taxes in addition to the 5% state levy. But this would be difficult, at least in Tacoma, where the city charter states that the city's gross earnings "shall not be disproportionate to the . . . . taxes the utility would pay if privately owned and operated."

Proponents of the legislation say it would:

1. Eliminate difficulties in setting valuations for private utilities;
2. Put municipals, REA's and private utilities on the same basis for local taxation;
3. Put these three types of electric utilities on a basis similar to that used for PUD's serving largely rural areas;
4. Relate local tax revenues to the level of electric energy revenues rather than to the more static base of property value.

Financing May Delay Oroville Dam 10 Years

Construction of California's Oroville Dam on the Feather River may be delayed at least ten years if the state Department of Water Resources follows the recommendation of its financial and engineering consultants. Although the interim reports of engineering consultant Charles T. Main Inc and financial consultant Dillon, Read & Co judge the project to be technically and financially feasible, they urge that the work be split into two stages.

The first part, a $1.322-billion aqueduct, to supply the southern part of the state's water needs to 1980 would be started immediately. The second stage, the $372-million dam, would provide additional water and power generation.

But since the additional water provided by the dam will not be needed until 1980, the Main report concludes that "It is not feasible to charge water users for interest on bonds during this period when there is no sale for and no revenue from the Oroville water."

The state's original plans called for dam construction to be started in 1962, with completion in 1969. California Water Resources Director Harvey Banks agrees the aqueduct should be started first but will still try to keep the dam project on its original schedule.

The Dillon, Read & Co interim report did not include any conclusions about the proposed contracts for sale of water and power. These will be covered in the final report, expected to be released in October. Revenues from these must, by law, pay operating, maintenance, and replacement costs as they occur.

Inflation appears to be the major reason for the suggested delay. The Charles T. Main report warns that if escalation continues its upward trend, there will not be sufficient funds to complete both the aqueduct project and the dam. The concurring Dillon, Read report says there is a 25% safety margin between estimated construction costs of the first stage and available funds, but not enough to build the dam.

As an alternative, Banks has suggested that the dam might be built with revenue bonds. However, present estimates indicate that power revenues will fall just short of making the dam self-liquidating on that basis. And the dam will earn no water revenues until 1980, when more water than that provided by the first stage will be needed.

Another alternative being considered is to build the dam in stages. A low dam would provide urgently needed flood control and could include provisions for later addition of power and water conservation facilities. The Main report concedes that flood control is the only real basis for immediate construction.

The engineering and financial studies, costing the state $550,000, are being made for the benefit of voters who act on a $1.75-billion bond issue in November.

Computer Meeting to Study Power Systems Use

"Computers for engineering and power" will be the theme of the second Power Industry Computer Application Conference, to be held Nov. 9-11 at the Chase Hotel in St. Louis, Mo. Latest developments in computers for utility engineering and plant automation and control will be presented. The meeting is cosponsored by the Power Division and Computing Devices Committee of the American Institute of Electrical Engineers.

British use of digital computers in power system engineering will be discussed by Prof Humphrey Davies, Professor of Electrical Engineering at the University of London, at one of the luncheons. The other luncheon speaker will be J. W. McAfee, president of Union Electric Co.

General sessions will cover: **(1)** Power system analysis by digital computer; **(2)** Economic system operation using computers; **(3)** Computers for advanced system planning; and **(4)** Control computers for plant automation and data gathering.

A special feature will be an afternoon and evening discussion in which groups may talk over specific areas of interest in engineering or control. Subjects for discussion may be suggested to the conference program chairman, Dr E. L. Harder, Westinghouse Electric Corp, 700 Braddock Ave, East Pittsburgh, Pa.

In addition, general presentations will cover characteristics of available computer systems and programming techniques, and an outline for computer program interchange. Arrangements for computer services in general service bureaus and at other location will be covered. Trips to two large computer centers and exhibits of smaller computers are planned.

COMPUTERS FOR ENGINEERING and power will be explored at the 2nd Power Industry Computer Application Conference under F. J. Maginniss, conference chairman, and Dr E. L. Harder, program committee chairman

CASTRO cites US 'economic aggression' as reason for seizure of American properties

MOCK FUNERAL BY ARMED MILITIAMEN celebrates the 'death' of Cuban Electric Co as an American-owned enterprise. Sign shows 'Calixto Kilowatt' the company's advertising mascot, saying 'Now I am indeed Cuban'

Castro Seizes Cuban Electric Co

Compensation for $300 million American & Foreign Power Co subsidiary is dependent on future US sugar purchases

Armed Cuban troops and militia seized American & Foreign Power Co's $300-million subsidiary close on the heels of Fidel Castro's nationalization proclamation. Seizure of the Cuban utility, the country's largest private employer, had been in the offing for some time.

Although the Castro government had been criticizing Cuban Electric for several months, because of a halt in its huge expansion program after revenues were slashed more than 25%, the seizure was nominally in retaliation for "economic aggression" by the United States. Other US properties valued at $400 million were seized at the same time.

In a move that may reflect the impact of the recent US reduction in sugar purchases on the Cuban economy, Castro tied compensation for the seized properties to future American sugar purchases. He asserted that compensation for the expropriated properties would be with 2%, 50-year bonds, to be paid off by 25% of the value of US sugar purchases in excess of three million tons at a minimum price of 5.4 cents per pound. Thus the rate and amount of compensation US stockholders would receive would depend directly on the amount of sugar purchased by the US.

Three million tons is the normal Cuban quota. In recent years, Cuba has always sold an additional 200,000 to 300,000 tons of sugar to the US, with a two-cent premium over the world market price, currently about 3.25 cents per pound.

The seizure was no surprise (EW, July 11, p 52). A&FP executives were prepared for the entrance of militia and rebel soldiers Saturday night (Aug. 6) shortly after Castro announced in a speech that confiscation would take place. The presence of the armed troops was explained as sabotage prevention.

Communications Minister Raul Curbelo Morales entered the main office the next morning to give the confiscation order to John Plunkett, president of Cuban Electric.

A&FP officials predict that the utility will function smoothly for a time because virtually all employees are well trained—and are Cubans. Swiss and German mechanics are on hand in the event there is minor breakdown trouble, but if something should go wrong with the six Westinghouse turbine-generators the utility will have serious problems.

All six Americans with A&FP are separated from the operation now. Cubans immediately changed the name from Cuban Electric Co to "Antonio Guiteras," honoring a Cuban that fought the "American monopoly." Angel Gomez Trueba was made administrator in a ceremony that A&FP men attended.

Program Set for Street Lighting Meet

Sherman R. Knapp, president of Connecticut Light & Power Co, and Edison Electric Institute, and W. W. Sproul Jr, vice president, General Products Group, Westinghouse Electric Corp, will be among the featured speakers at *Electrical World's* Second Street & Highway Lighting Conference.

Keynote speaker will be Edwin Vennard, vice president and managing director of EEI.

The meeting is scheduled for Oct. 19 and 20 at the Hotels Ambassador, Chicago.

Electrical World is conducting a street and highway lighting survey among the nation's utilities. Results will be presented at the conference.

Conference announcements and a preliminary program will be mailed to utilities this week. For details contact J. D. Damon, EW, 330 W 42nd St, New York 36, N.Y.

BPA Sets Sale of 375 Mw to Four Industries

Tentative allocation of firm and secondary power is based in part on Columbia River system generator schedule

Tentative allocations for sale of 375 Mw of combined firm and secondary power to four industries have been made by Bonneville Power Administration. The last allocation made was to Harvey Aluminum Sept. 13, 1955.

The four industries are:

Webb & Knapp Co, Inc, constructing a steel mill at Anaconda, Mont., to reclaim copper and zinc and produce about 350,000 tons of steel annually from slag, allotted 44,000 average kw of firm and 52,000 average kw of secondary power starting July, 1962.

United Pacific Aluminum Corp, constructing two aluminum potlines at a site near Longview and possibility of some processing locally, allotted 45,000 kw of firm and 75,000 kw of secondary with initial service not later than January, 1962.

Harvey Aluminum, Inc, constructing two additional potlines at a location not yet determined, allotted 75,000 kw of firm and 80,000 kw of secondary power, with initial service not later than December, 1963.

Crown Zellerbach Corp, modification of pulp processing at the Port Townsend, Wash. plant, allotted 2,000 kw of firm and 2000 kw of secondary, initial service date to be announced later.

Availability of the new power is based on generator schedules of the Columbia River power system and and estimated requirements of BPA customers. BPA says it is assumed that generator additions of the Corps of Engineers and Bureau of Reclamation will proceed as scheduled.

More power will also be available to utility customers of BPA to meet future requirements under existing contracts.

The new allocations will be sold under BPA rate schedule C-4, which is $17.50 per kilowatt-year at high load factor (in the neighborhood of 95%), which is about two mills.

Administrator William A. Pearl said:

"Successful completion of contract negotiations based on letters of intent from each company will be dependent in part on supplemental appropriations to permit BPA to construct major grid additions to serve the two new industries (Webb & Knapp and United Pacific). Financing arrangements by the companies and firming up of BPA service plans are expected to be resolved in the near future."

Completion of the contracts would boost BPA's annual revenue by about $6.5 million.

An additional 16,000 average kw of firm power above the initial offer (in May) of 150,000 kw has been made available for Montana in connection with Hungry Horse project.

Bonneville attributes availability of the block of power to the "unprecedented expansion of non-federal hydroelectric generation in the Pacific Northwest," as well as to generation still to be installed at federal plants.

New Zealand Project Ahead of Schedule

Work on New Zealand's Benmore hydroelectric project on Waitaki River is proceeding faster than had been expected. It is planned to divert the Waitaki this winter instead of in 1961, as originally intended.

The giant South Island power scheme has a planned installed capacity of 540 Mw, based on a 50% load factor. It is expected to begin operating by winter, 1965.

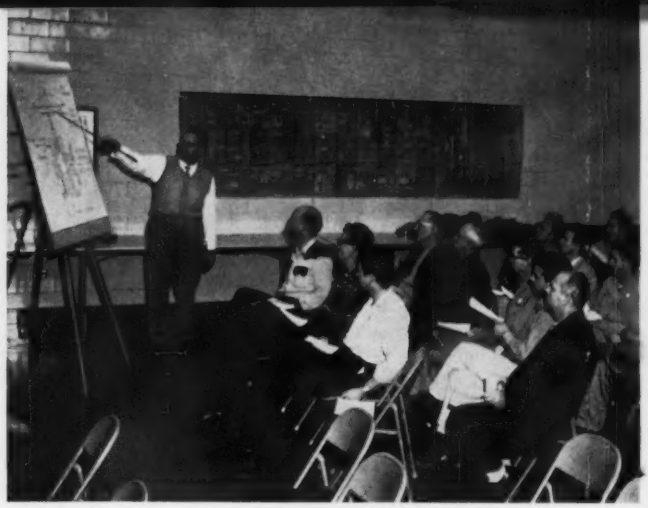
Estimated cost of the project is over $100 million. Approximately $5 million has been spent so far.

Total potential capacity of Waitaki River development is 1,500 Mw, including the 105-Mw station at Waitaki, the 25 Mw one at Tekapo, and the lake control schemes at Pukaki and Tekapo.

Construction of the Benmore earth dam is expected to take three years. Crest length will be 2,000 ft and maximum structural height, 360 ft.

Bailey Bridge (photo, center), site of the dam, is at present the only access across Waitaki River. Callender-Hamilton Bridge, under construction downstream, will be completed before the start of major dam concreting at the end of the year.

Continuing Training Program Helps Keep Station Operators On Toes



CLASSES are conducted at each power station after hours

Organized course provided by special training department in System Operations keeps operators' memories refreshed, helps them qualify for advancement. Tests play key role

RICHARD E. BARRETT, Superintendent of Training, System Operations, Public Service Co of Oklahoma, Tulsa, Okla.

Public Service Co of Oklahoma has found that a well-organized and continuing operator training program has measurably increased the knowledge and skill of operating personnel. Knowledge that they can safely and economically perform their duties has greatly increased the self confidence of operators. These men take pride in being able to answer quickly and correctly questions covering normal or emergency operating procedures.

There have been many instances in the past two years which have proved the performance of operators under adverse conditions. These have shown the value of the continuing operator training program.

Training Had Been Keyed to New Units

Prior to 1955, Public Service Co of Oklahoma conducted its power station operator training in much the same manner as the average industrial company. When a new piece of equipment was purchased and installed or a new turbo-generating unit put in service, a concentrated training program was conducted to teach the operators how to operate the new equipment efficiently and economically. After the operators became proficient, training was almost dormant until a further need was anticipated.

This system works well as the initial training step. However, it does not keep the operator's memory refreshed or provide training for new employees. It does not help operators to qualify for advancement.

As power system operation became more complicated with the development of higher pressure and higher temperature turbo-generating units, higher transmission voltages, more advanced distribution systems, and their many allied automatic controls, the responsibility of operators became more complex. With these developments it was apparent that well trained, highly skilled men were essential to efficient system operation. Therefore, an Operations training department was established and a continuing operator training program put into effect.

Step by step, the various training programs were established. They now include: **(1)** Continuing power station operator training; **(2)** Continuing substation operator training; **(3)** Maintenance personnel training; **(4)** Initial training of new graduate engineers assigned to power stations.

Station Operator Program Is Oldest

Since the power station operator program was the first established, it has progressed farther than the others. This program is divided into three phases: **(1)** Class work; **(2)** Drawing of one-line diagrams from memory; **(3)** "Test-flight" type examinations. Each phase is fully covered in separate training memorandums issued by the training department and forwarded to power stations the first of each calendar year.

Operators attend classes on their own time. Classes are scheduled just before a shift goes on duty and just after a shift goes off duty. They are held in the power stations. A minimum of one class a month is scheduled in each power station. Additional meetings are held for special subjects.

The chief engineer of each station is responsible for the material and presentation at eight classes each year. Four meetings each year are conducted by general office personnel as arranged by the training department.

After each meeting the attendance is recorded and the subject matter covered is summarized, including a copy of "pass-out" material. These records are forwarded to the training department.

Training in station electrical diagrams keeps operators who do switching from becoming "rusty" on this essential contribution to efficient station operation. It refreshes their memory on the layout of electrical switching facilities and keeps them up on constant changes due to system expansion.

OPERATORS are encouraged to discuss exams on the job

STUDENTS occasionally receive helping hand at home

Once each quarter all men who do electrical switching draw, from memory, one-line diagrams of the substations or station bus sections for which they are responsible. Diagrams are checked by a member of the chief engineer's staff and then forwarded to the Operations training department. Here they are rechecked, graded and the results recorded. They are then returned to the originator so that he may see his errors.

On these diagrams operators are required to show: **(1)** Generators—giving unit number and capacity; **(2)** Buses—identifying the bus and indicating the voltage; **(3)** Transformers—giving the bank number or name and rating; **(4)** Breakers, oil and air, indicating the breaker number and suffix letter which shows whether the breaker is automatic or manual reclosing; **(5)** Disconnects and by-pass switches—showing location and direction switch opens; **(6)** Potential transformers—indicating the location and quantity; **(7)** Capacitors—showing location and rating; **(8)** Reactors —showing location and rating. When drawing diagrams are submitted during the third quarter, red and green pencils are used to indicate whether switches are normally closed or open.

'Test-Flight' Type of Exam Is Used

In order to determine the effectiveness of the training program, the idea of the "test-flight" type of examination was borrowed from the commercial air lines. These examinations show where more concentrated training is needed. They also show whether operators are prepared to perform their jobs safely and efficiently.

Each operator is examined twice a year for the classifications in which he is currently working. The examination is intended to be a comprehensive test of the operator's knowledge and ability and takes about four hours for the average operator to complete. The test is divided into two parts, consisting of a two-hr written and two-hr oral check.

The written portion of the test is difficult although it is, in effect, an "open-book" examination. The men are given a few days to write the answers on the job, or at home, as they prefer. They are encouraged to discuss the questions among themselves. The aim is to be sure that each operator knows the correct answers to questions about his job. Results of this part of the quiz are checked very critically as it is of the "open-book" type.

Questions used in the written test are of the following types: **(1)** Questions with blank spaces for the operator to fill in correct information; **(2)** Statements requiring a true or false decision; **(3)** Multiple choice questions; **(4)** Questions requiring answers in the operator's own words; **(5)** Questions requiring the operator to draw, from memory, one-line diagrams either electrical or piping depending on the particular operator's job.

Oral Tests Conducted in Work Area

The oral part of this examination is given by: **(1)** Walking through the working area of each operator and asking him to identify and discuss the operating procedure for various items of equipment. **(2)** Discussing electrical and mechanical emergency procedures with the operator. **(3)** Discussing appropriate one-line diagrams, electrical or piping, with the operator.

The effectiveness of the "test-flight" type examination depends on the thought, time and effort used in preparing the questions. After each examination the questions used are discussed in a regular training meeting.

The chief engineer and his staff, at each power station, are responsible for administering the examination and for checking and grading each operator. The results are forwarded to the training department.

At the end of each calendar year the System Operations training department makes a re-cap of all training data recorded during the year and forwards a copy of the pertinent facts to the chief engineer of each power station. From these records and frequent visits to power station operator training meetings the training department is able to keep in close touch with the progress made in power stations.

In addition to the program outlined all power stations conduct "on-the-job" training for various individuals who are qualifying themselves for promotion.

Computer Keeps System Costs

Both transmission and incremental generating losses are taken into account; tie-line flows are maintained

HARRISON HUBARD, Chief System Operator, Virginia Electric & Power Co, Richmond, Va.

Virginia Electric & Power Co's Desired Generation Computer, put in service November 1 of last year, accomplishes two tasks: It maintains scheduled tie-line flows and loads the scheduled generating equipment in such a way as to keep total system production costs at a minimum for a given total load by considering transmission losses as well as incremental generating costs.

In addition to taking transmission losses into account, a considerable improvement results from the use of electronic function generators to represent the incremental heat rate vs. output relationship of each major generating unit.

A change in station loadings has been noticed since the Desired Generation Computer began operation. Stations in power-short areas carry more load than had been the case, because transmission losses are now considered. The savings resulting from the change, while not evaluated, are expected to be at least $50,000 per year.

Although there have been a few minor difficulties, operating experience has generally been satisfactory. The computer has been in almost continuous operation since the initial installation. The few difficulties have been corrected by VEPCo maintenance personnel.

Interconnection power flow from five tie points is measured at the tie points by wattmeters, and the information is telemetered to the System Operator's Office in Richmond. There, within the computing equipment, the algebraic sum of the tie-line flows, called "Net Interchange," is compared with the schedule.

The difference between these quantities plus the frequency bias is called "Area Requirement." Area requirement or regulating error is the quantity used to initiate controlling impulses. It operates a "Master Controller" which originates either raise or lower impulses. These, when received in a station, change generation to reduce the area requirement to zero.

The computer determines which stations should change generation in response to the area requirement, and the raise or lower impulses are allowed to pass only to the designated stations. When the impulse is received in a station, the station equipment determines the unit within the particular station that should change generation, and the impulses terminate by changing the governor motors of the designated unit.

As the generation changes, the tie-line flows change and the area requirement is reduced to zero. This process goes on continuously. The regulating error as shown on the area requirement chart covers a band of 10 Mw or less under normal conditions.

Production Cost Minimized

Scheduled generating equipment is loaded to minimize production costs. By "scheduled generating equipment" is meant the equipment that the System Operator has scheduled to operate for the day, after estimating expected load and providing adequate spinning reserve and area protection. The computer economically dispatches equipment in operation, but the System Operator must determine what units should be available.

The computer adds, subtracts, multiplies and divides to solve the equations that are the basis for economic dispatch. The first equation is a restatement of the objective that total production cost shall be as little as possible at any particular time. To write this statement more concisely:

$$F_t = \Sigma F_n = \text{minimum} \quad \begin{matrix}(\text{where } F_t \text{ is total fuel cost and} \\ F_n \text{ is fuel cost at station "n."})\end{matrix} \quad (1)$$

There is general agreement that when transmission losses are neglected, economic dispatch is achieved by operating all generating units at the same incremental production cost. Incremental production cost for a generating unit is the cost of producing the next

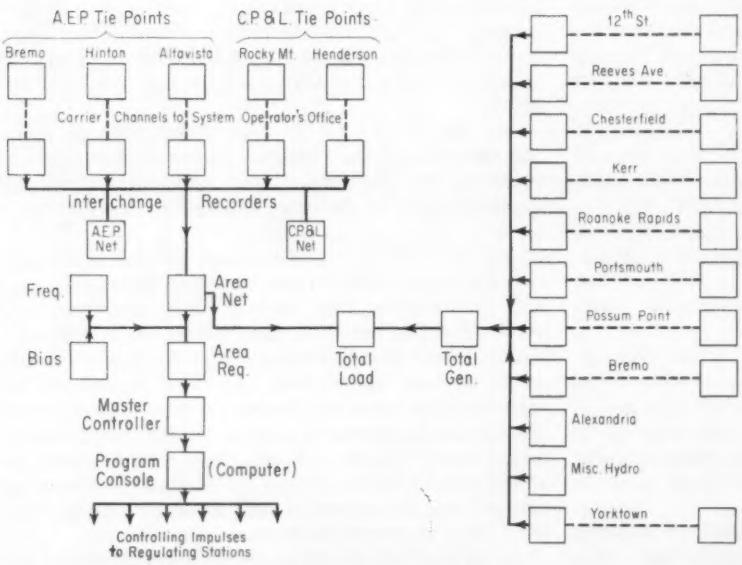


FIG 1—INTERCONNECTION POWER FLOWS are measured. The algebraic sum of tie-line flows, called "Net Interchange," is compared with the schedule

Minimized

megawatt on that unit above the amount presently being generated. Stated another way, it is the slope of the input-output curve for the unit, or the first derivative of the equation for the curve:

$$\text{Incremental production cost} = \frac{dF_n}{dP_n}$$

If we let the Greek letter lambda, λ, stand for the value of incremental production cost at which all units are to be operated, this results in the equation commonly used when transmission losses are neglected:

$$\frac{dF_n}{dP_n} = \lambda \qquad (2)$$

To take transmission losses into account all units are operated at the incremental cost of power delivered to the load, rather than at the incremental cost of production at the station. This can be expressed as follows:

$$\text{Incremental cost of power delivered} = \text{Incremental cost of production} + \text{Incremental cost of transmission losses}$$

$$\text{In symbols, } \lambda = \frac{dF_n}{dP_n} + \lambda \frac{\partial L_n}{\partial P_n} \qquad (3)$$

The new term, $\partial L_n/\partial P_n$, is the change in losses due to changes in generation at station "n." In the computer this value is determined by the transmission loss matrix when the generation at each station and tie point is fed into it. The transmission loss matrix consists of a network of resistors whose values are derived from a mathematical analysis of the system.

Equation (3) is rearranged to the form:

$$\frac{dF_n}{dP_n} = \lambda\left(1 - \frac{\partial L_n}{\partial P_n}\right) \qquad (4)$$

In the computer dF_n/dP_n is divided by the fuel cost (FC) to obtain the incremental heat rate for a unit:

$$\text{Incremental heat rate} = \frac{dH_n}{dP_n} = \lambda\left(1 - \frac{\partial L_n}{\partial P_n}\right)\left(\frac{1}{FC}\right)$$

For each unit, there is only one value of desired generation for each value of incremental heat rate, so if the incremental heat rate is known the desired generation can be determined.

Reference to a simplified schematic diagram of the computer is helpful (Fig 2). Consider the system as balanced before an additional load causes an area requirement. The area requirement drives the lambda servo to a new mechanical position which results in a new value of lambda. This value is multiplied by $(1 - \partial L_n/\partial P_n)$ for each station to obtain dF_n/dP_n.

Next, at each station dF_n/dP_n is divided by the fuel cost to give dH_n/dP_n. This value is applied to

(*Continued on page* 96)

SYSTEM OPERATOR'S OFFICE in Richmond shows arrangement of computer and associated equipment. It uses existing telemetering and load control channels

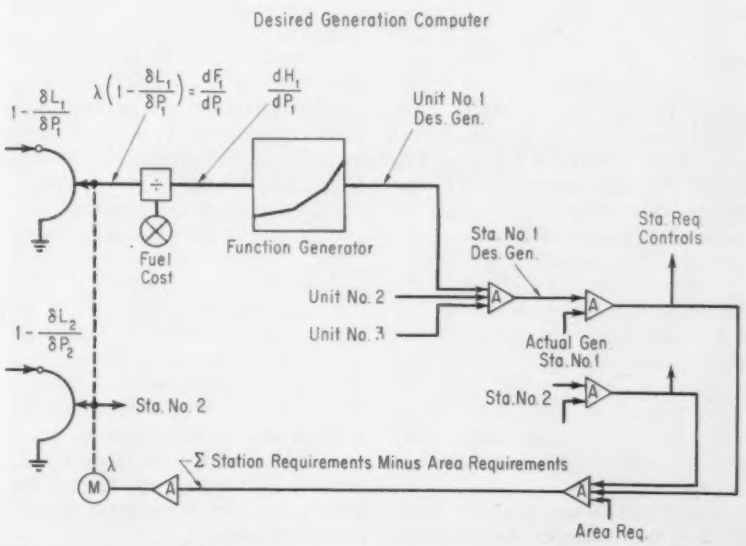
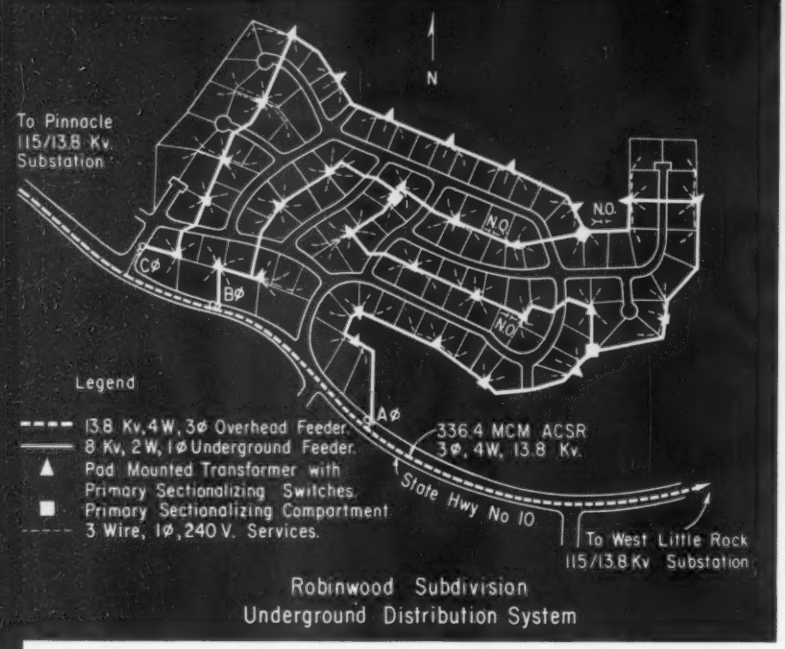


FIG 2—SIMPLIFIED SCHEMATIC DIAGRAM shows servo operation. Impulses from the master controller are sent to each station until balance is obtained



Robinwood Subdivision
Underground Distribution System

Custom

Special design permits easy replacement; high demand calls for individual services direct from transformers

SUBDIVISION DISTRIBUTION comprises three single-phase cable circuits. Each can carry the initial subdivision load of 1,400 kva within 2% voltage drop

M. W. RICE, Distribution Design Engineer,
R. W. TOLER, Electrical Engineer, Design Section,
L. B. HAYDEN, Division Engineer, Little Rock Division, Arkansas Power & Light Co, Little Rock, Ark.

Residential underground being installed in a subdivision by Arkansas Power & Light Co uses custom-designed transformers which are readily changed without disturbing the primary circuit. The 13.8/8-kv loop near Little Rock will ultimately serve 125 residences in the $50,000 to $100,000 class on lots of 150 ft average width.

High consumption was anticipated. The first service request listed a connected load of 80 kva with a diversified demand of 35 kva. The utility and the developer felt that the heavy connected loads and the better appearance justified the added cost of underground distribution.

Major features of the Robinwood Subdivision installation are:

- Primary feeder and transformer sizes selected for a diversified demand of 15 kva per lot.
- Duct without concrete cover, called for by the extremely rocky terrain, which precluded direct burial of cable.
- A common trench, dug and backfilled by the developer, for telephone and power cables.
- Cables and transformer assemblies installed along the rear property lines in a 5-ft easement exclusively for power and telephone companies. This was half a total utility easement of 10 ft. The other half was for sewers.
- Service directly from the transformer to each customer. This eliminated choosing an adequate secondary main with its high cost, and allowed each service to be tailored to the customer's need.
- A weatherproof transformer assembly with integral cable-terminal compartments mounted without additional enclosure on a pad with complete safety.

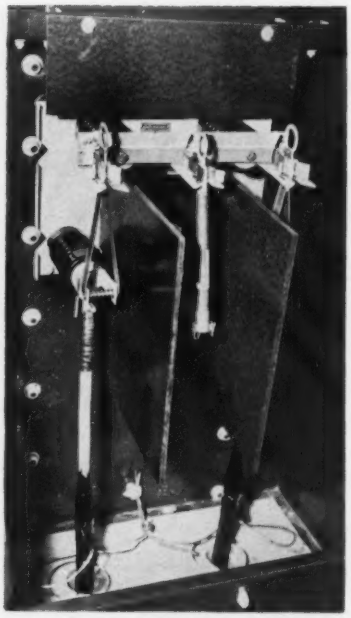
The excess cost of installing underground as compared with overhead distribution and services was shared by the utility, developer and customers. As a preliminary to suitable allocation of this cost, AP&L engineers prepared estimates for this underground system and for conventional overhead distribution, both installed along rear lot lines. The estimates indicated the cost of underground as 180-200% of the overhead cost. The developer agreed that he and the residents share the major portion of the excess cost of underground in this manner:

1. The developer to excavate and backfill the trenches and furnish the service duct for installation by the power company.

2. Each customer to install, own and maintain his service from the lot line to the service entrance at the rear of the house.

3. The power company to furnish and install all electrical facilities located in the easement, including that portion of the service between the transformer and the customer's lot line.

4. The developer to cover a sub-



PRIMARY COMPARTMENT contains fuse and two sectionalizing switches

Units Aid Residential Underground

stantial portion of the remaining cost difference between underground and overhead.

5. Customers desiring 3-phase service to pay its further cost.

Cooperation with the developer and telephone company engineers enabled solution of many problems in the planning stage, hence better coordination during construction work.

Power and telephone company engineers made a joint layout of both installations, wrote trenching and backfill specifications for the developer, specified respective elevations and locations of the power and telephone cables in the joint trench, and located telephone service pedestals and power transformers to minimize crossing conflicts between services. The developer extended sewer taps to individual lots beyond the easement line before the utilities' cables were laid. He also furnished the asbestos-cement duct for services. The electric company installed it without concrete cover and hand backfilled with 6 in. of sand or loam. This prevented duct breakage while backfilling by bulldozer.

The primary layout consists of three single-phase 8-kv underground feeders installed in the easements along rear property lines. Insulated conductor is in 3-in. duct, with an equivalent-size bare copper primary neutral direct buried. This duct and the neutral were installed at the same time as telephone cables. Lines in common trenches have a minimum of 1 ft of earth separation between the power and the telephone cables.

The three feeders are arranged in a loop with sectionalizing at each transformer providing two-way supply to each. Each feeder normally serves one-third the total subdivision load and is energized from a separate phase of an overhead 13.8/8-kv feeder circuit along the adjacent highway. The overhead feeder is also a tie circuit between two major 115-13.8-kv substations. Thus there are two sources of power to the subdivision.

The primaries are No. 2 stranded copper, 15-kv shielded cable with high-molecular-weight polyethylene insulation and polyvinyl chloride jacket, for use with grounded neutral. One primary cable can carry the estimated initial subdivision load of 1,400 kva with a maximum voltage regulation of 2% and without exceeding rated capacity.

Polyethylene insulation was selected for its excellent dielectric and moisture-resistant properties and for overall economy. Choice of this in lieu of rubber-insulated cable saved more than the installed cost of the primary duct.

Cables Carefully Tested

Since utility experience with 15-kv polyethylene-insulated cable is limited and the successful low bidder for the cable had the necessary equipment, foot-by-foot ionization tests were specified as a precaution that the insulation be free of voids and air bubbles, which could cause cable failure.

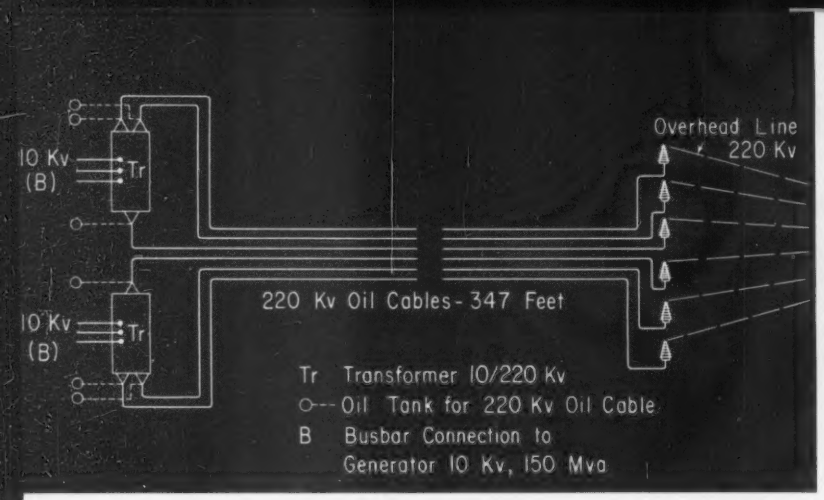
Terminations on the riser poles were made with compound-filled porcelain potheads. Hence 15-kv rubber-insulated cable was installed from there to the first primary compartment of each feeder to eliminate the possibility of hot compound melting the polyethylene insulation and creating voids.

A pad-mounted transformer assembly was designed jointly by Central Transformer Corp and S&C Electric Co, in close cooperation with AP&L engineers, and incorporating features desired by the utility. Included are similar high and low voltage compartments bolted to opposite sides of the transformer. The symmetry of appearance, complete isolation of all live parts and weatherproof construction permit pad mounting of the assembly without an additional enclosure. Forest green color of the assembly blends with the wooded surroundings.

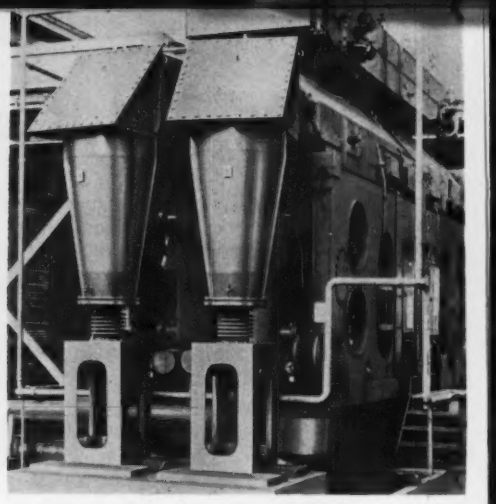
Primary compartments, which have switching facilities for loop feed, were installed alone on the transformer pads well in advance of the transformers with secondary compartments. This permitted completion of the primary loop and the establishment of sectionalizing points before having to pick up any load, and postponed transformer in-

(*Continued on page* 110)

SECONDARY COMPARTMENT holds two short buses bolted to the bushing lugs. Each takes up to eight service cables, fused in the compartment as shown



SCHEMATIC LAYOUT shows the 220-kv cable installed in 1952 at Goldenberg Power Plant. Cable ties this major station into the German high-voltage network



ELEPHANT HEADS is the name given funnel-shaped lead-in chambers

220-Kv Cable Ties West German

Trouble-free history prompts utilities, manufacturers to test and plan more uses

MORRIE HELITZER, McGraw-Hill World News, Bonn, Germany

A 220-kv cable tying Goldenberg Station, a major West German power plant, into the country's high-voltage network has given virtually trouble-free operation since installation. Its success has prompted the utility, Rheinisch-Westfaelisches Elekrizitaetswerk (RWE), to construct more such installations, and to consider even higher cable voltages.

Meanwhile, studies to find means of cutting the cost difference between overhead and underground 220-kv lines have been undertaken by West German utilities in conjunction with the principal electrical manufacturers, Felten & Guilleaume and Siemens Schuckertwerke. At present, costs four or five times those of 220-kv overhead lines restrict underground cable to special applications.

Some roads to savings are cut off, notably, further reduction in the thickness of cable insulation. The limit in insulation thickness was probably reached when West German utilities boosted their cable dielectric to 11 kv per mm instead of the previously accepted 8 to 9 kv per mm. Accordingly, the studies will probably converge on some other aspect.

But five years of operating experience with the first lengths of cable, said Dr Hermann Roser, a RWE technical division director, produced only a single major modification in terminal connection. A horizontal arrangement of the outdoor terminal box, linking the cable with a transmission line, replaced a vertical one. This modification was applied to RWE plants in 1957 and 1958.

At Goldenberg, pollution from the power plant and adjoining industrial works resulted in occasional flashovers, Dr Roser explained. The vertical insulators were especially designed, however, so that neither the cable nor the porcelain was damaged. In any event, these insulators are now under cover in a small switching station which RWE built on the site. In more recent installations, the jute jacketing used to protect the first cable's sheath against corrosion has been replaced by PVC.

Direct introduction of the cable into the transformer housing offers savings of about $12,000, Dr Roser estimated, achieved through elimination of outdoor terminal boxes in favor of funnel-shaped chambers, known as "elephant heads." Apart from these modifications, the basic planning for the Goldenberg 220-kv cable system has been applied to subsequent installations.

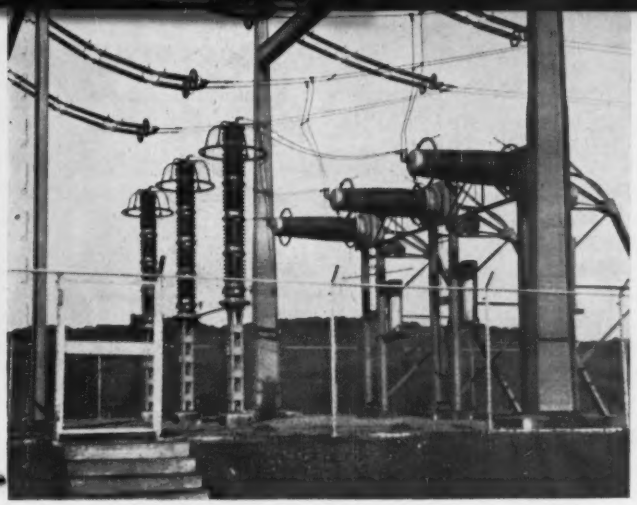
These Factors Were Considered

This plan was described by Dr Helmuth Brauns of Felten & Guilleaume, cable manufacturer, as follows:

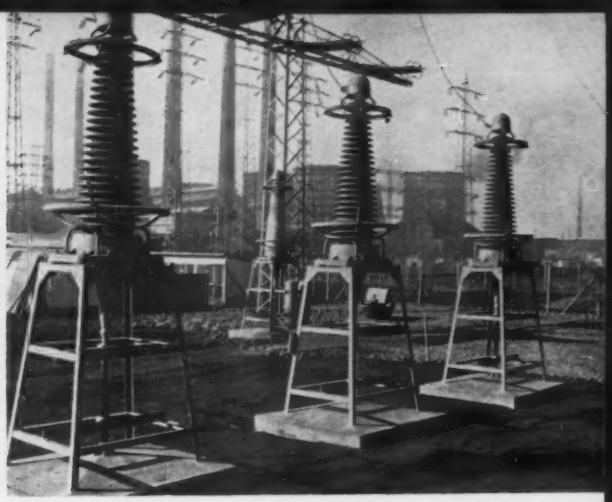
"In 1952 at Goldenberg, a large power station in the Rhineland brown-coal area, two new power units were erected, each having an output of 150 Mva and capable of being stepped up direct from 10 to 220 kv. To minimize losses between generators and transformers, it was necessary to place the latter as close as practicable to the power units.

"It so happened that the only free space was a yard surrounded by tall buildings. As this was inaccessible to a 220-kv overhead line, the power supply had to be fed to the starting point of the overhead section through two 220-kv cable systems, each about 600 yd long. Also influencing this decision was the fact that, with overhead line insulators in the actual power station area, the risk of flashover would have been considerable due to the adverse effect of cooling vapors and smoke.

"Lightning arresters were omitted at the transition



HORIZONTAL BUSHINGS at outdoor terminal boxes minimized flashover due to atmospheric pollution at site



VERTICAL BUSHINGS were installed originally at outdoor terminal boxes, but were subsequently replaced

Station to Overhead Network

point from cable to overhead line. Protection of the cable from excessive surge impulses, therefore, required special provisions at the cable terminal boxes and the juncture with the overhead line. The cable ends were equipped with safety gaps having a flashover width of 51 in. and with large, carefully-shaped arc-protective fittings. The latter are important for safeguarding porcelain insulators against the pollution hazards in the power station's vicinity.

"To prevent direct lightning strikes near the cable terminal boxes, the ground wire was placed high enough over the 220-kv twin cables for all conductor wires to lie within its angle of protection. The ground resistance of the last four pylons is kept below 10 ohms, even in dry conditions.

"A further improvement in efficiency and quality of grounding was achieved by laying an underground line between the last four pylons to join up the ground connections. The lower protective fittings of the outdoor terminal boxes were grounded jointly with the cable sheathings and the iron supporting structures. The cable sheathings were included in this grounding system and were situated at the other end of the grounding network of the power station. This end has a very low ground resistance of about 0.4 ohm."

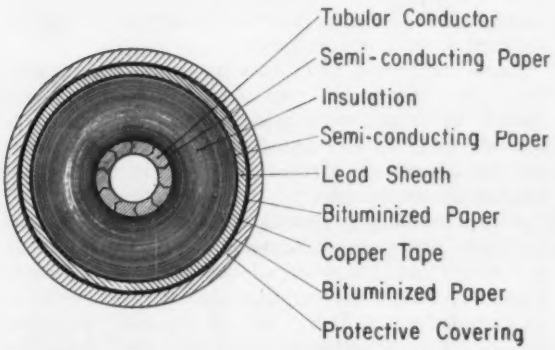
The system was designed for a rigidly grounded neutral point, but loading was low enough during the first two years to permit its insulation. Changeover came in November, 1954.

The cables were laid in the ground for the first 325 yd from the outdoor terminal boxes and in a subterranean concrete conduit for about 270 yd to the transformers. The part of the conduit accommodating the 220-kv cable is separated by a thick wall from that holding many lower voltage and signal cables, so that in event of damage they will not affect each other. The lead sheath of each cable can withstand a 13,000-amp short-circuit current for 3 sec.

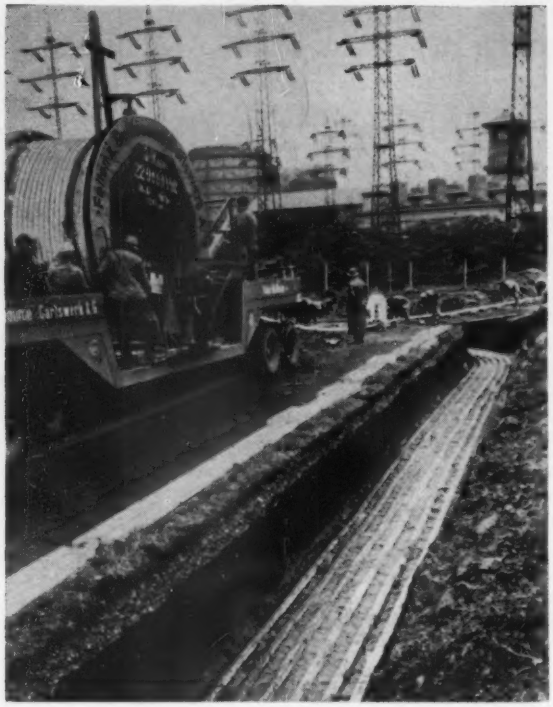
As the return current during ground leakage would seek to flow back to the conductor by the shortest route, a ground wire with a cross-section area of 0.6 sq in. parallels the 220-kv cables. This provision weakens the leakage field, so that no disturbing currents are induced in lines of the adjacent conduit.

A seventh cable was laid as a spare for use when one 220-kv cable or its terminal was damaged. The cable's outdoor terminal is behind the other six boxes, where it can be connected to any phase of the outgoing overhead line through an auxiliary bus. At the transformer end the reserve cable terminates in front of the junction to the transverse conduit. To use this cable, the reserve loop lying in the conduit's entrance is uncovered and the cable's end is brought to the appropriate transformer lead-in.

Thin insulating oil is fed to the 220-kv cables from



220-KV CABLE, linking power plant to transmission system, is shown in cross-section with dimensions



SPECIAL TRAILER laid the cable and transported the 10.5-ton cable drums. Cable was paid out over rollers

the transformer lead-in terminal boxes, where there is room for pressure tanks. Each cable has three 40-gal tanks. These control pressure fluctuations due to operating temperatures and maintain a 11¼-to-22-psig pressure on the insulation.

Describing the cable and its accessories, Dr Gerd Buss and Werner Ochel, both of Felten & Guilleaume, said: "As far as we are aware, this marks the first time in Germany when high-tension cables were introduced into the actual transformer housing, with marked advantages over the usual cable connection.

"Atmospheric pollution at power stations using coal or in industrial areas exercises no effect whatsoever. Much less space is required, as transformer bushings and outdoor cable terminal boxes with their connecting elements are no longer needed. Transformer and cable connections through the floor are accessible during operation, all live parts being metal-clad. This use of direct cable connection with the transformer is particularly suitable for vaults or underground plant sites.

"On the other hand, a possible disadvantage of such close union of two operating units, independent of each other in other respects, is that trouble with one can communicate itself to the other and replacement of either unit is thus rendered more difficult."

Each "elephant head," through which the cables are introduced vertically from under the floor, has attached to its lower end the foot fitting of the terminal box, which separates the cable's oil space from that of the chamber. The head of the terminal box, which is linked to the high-tension end of the transformer through a plug-type connection, is surrounded by a field-regulating electrode. This is RWE's normal practice in insulating bushings.

A corrugated tube forms the terminal box space between the funnel, where it is soldered to the cable sheathing, and the foot of the insulator, where it attaches to the transformer casing. The resilient tube is mounted vibration-free at the cable end on a support with its own bed, thereby preventing oscillations from the transformer reaching the cable. Transmission of oscillations by the conductor is prevented by a cushioning member between the terminal box head and the cable conductor. The stress cone is also on a vibrationless mounting in the cable lead-in funnel. The cone has control linings which help to combine small cone dimensions and maximum safety.

As the cable ends at the lead-in terminal boxes, the transformer or cable can be removed or exchanged at any time. The transformers connect to the outdoor terminal boxes beyond the area of heaviest pollution and very close to the power station. Yet changing winds can bring dust, smoke, or moisture. Control linings in the stress cone and metal rings on the top and bottom fittings improve voltage distribution, so that the voltage drop is as linear as practicable along the porcelain surfaces. In this way, flashover due to atmospheric pollution is minimized.

The protective fittings are shaped and have arcing horns to guide an arc away from an insulator. These horns, covering about a quarter of an insulator's circumference, are arranged radially at gradually widening intervals inclined 40 deg. Of the four arcing horns, supporting the upper and lower grading shields through their semiconducting connections, three terminate at the perimeter of the ring, and the fourth is extended to form an adjustable spark gap. The gap ensures that the arc is collected by the protective fitting and forced outward quickly. It also guards a direct-fed transformer's cable system against transient voltages from the overhead lines.

Cable Laid by Special Trailer

An eight-wheeled, double-tire, low-loader trailer laid the cable and transported the 10.5-ton cable drums. It was placed at about the midpoint of the cable system, from where the seven cables were paid out over rollers. During assembly of the outdoor terminal boxes, the horizontal cables were first attached to the connection bolts and to the stress cone and then placed upright in their final position. Assembly required a 1-ton traveling crane.

Lead-in terminal boxes were mounted on their supports for adjustment, and their connections were brought to the position required. Cable terminal boxes are adaptable to any transformer of the same type through adjustment of the cable riser in the conduit beneath the transformer.

Before installation, each cable, outdoor terminal box, and transformer lead-in terminal box withstood an ac test at 500 kv, following an impulse test at 900 to 1,000 kv. No puncturing occurred even after 24 hr in an extended test at 586 kv ac. A test cable, subjected to the maximum permissible load after undergoing the above tests, punctured only at four times its rated operating voltage.

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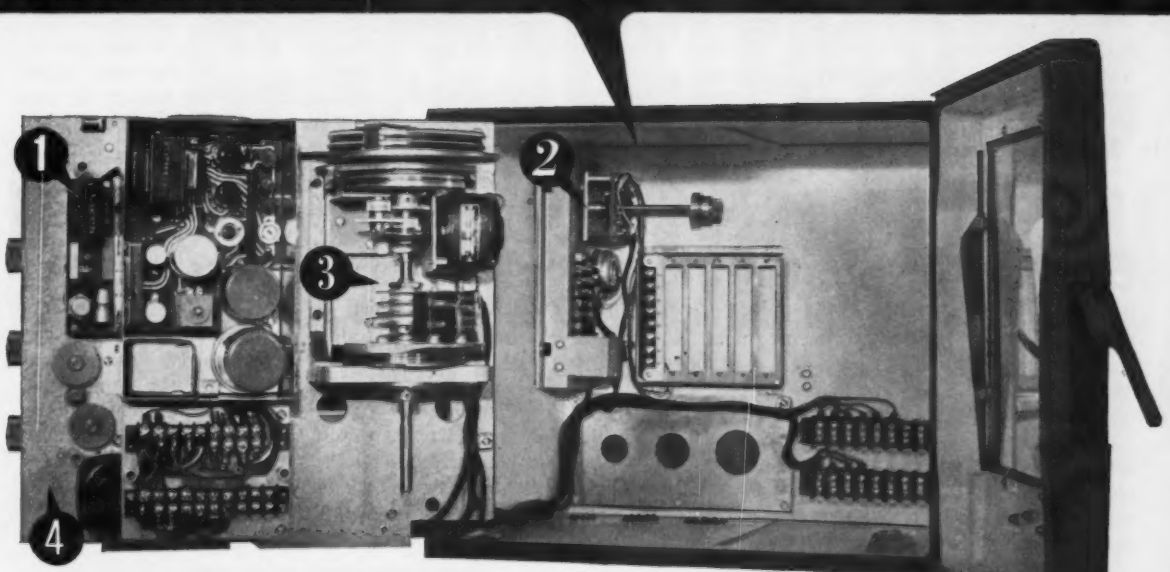

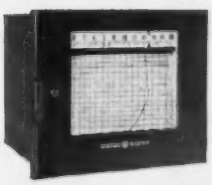

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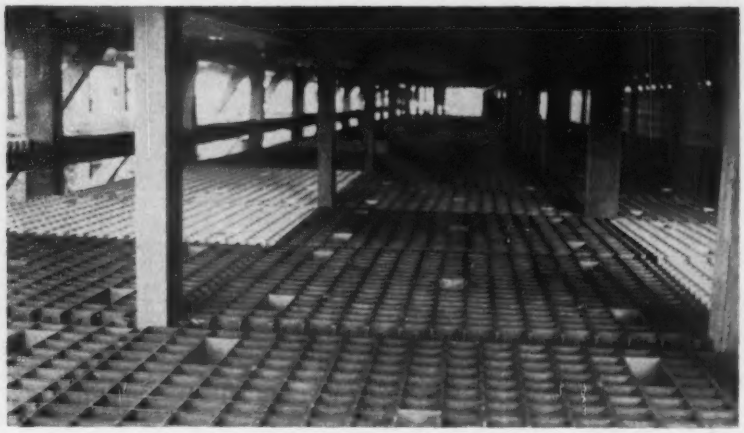
INSTRUMENT DEPARTMENT

GENERAL ELECTRIC

Plastic Fill Cooling Tower Resists Corrosion



The nation's largest plastic fill cooling tower is now in operation at Southwestern Public Service Co's Nichols Station, near Amarillo, Tex. The first unit, with a capability of 112,500 kw, was placed in service in June.

The Fluor Products Co, Santa Rosa, Calif., supplied the cooling tower, which is nearly 400 ft long and 60 ft wide. It contains about 40,000 3x3-ft polystyrene Poly-Grids.

Poly-Grids show exceptional resistance to corrosion and decay during the hot-to-cold water conversion process. Each unit is molded into a gridwork of vertical ribs in 2-in. squares. A top view of the fill looks like an egg crate, with the splash surfaces catching falling drops, breaking them into fine droplets and wetting the film surfaces. The large free area made available by the use of plastic fill makes a low-pressure drop possible.

A plastic fill tower was required because the station uses sewage effluent from Amarillo's sewage treatment plant, located five miles north of the station. The decision to use this "waste water" was a factor in locating the station. The drinking and washroom water comes from wells drilled at the station site.

Southwestern treats the sewage effluent at the station with pebble lime and alum to reduce its tendency to form scale in condensers. This also reduces the phosphates introduced into the sewage by detergents used by industry and residents.

Excitation System Has No Moving Parts

A new static excitation system concept eliminates moving parts for ease in maintenance on medium capacity steam turbine-generators. The system was designed to replace rotating exciters in the industrial and utility areas. Servicing, if necessary, can be undertaken without removing the load from the generator.

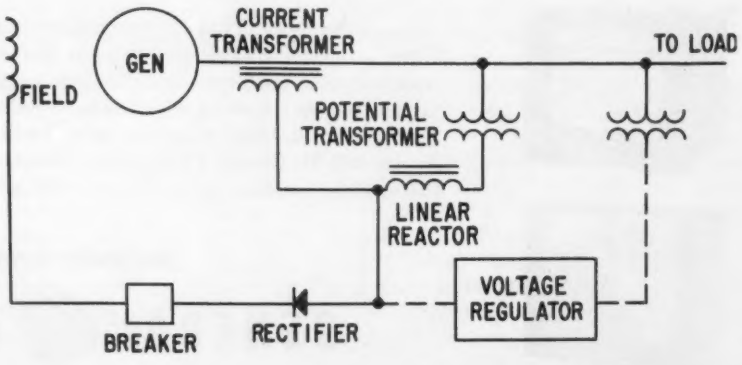
Some of the advantages of the static design include:

1. It corrects voltage dip quickly, assuring minimum disturbance to process equipment.
2. It maintains excitation at a high level during system disturbances, helping relays to clear faults quickly and to restore voltage.
3. It is flexible in arrangement and requires no special foundations.

The design of the static exciter differs from the conventional primarily in that the power is obtained from connection to the generator terminals instead of from the mechanical drive of the turbine-generator shaft.

A feature of the design is the utilization of both a current transformer and a potential transformer as the power source. Each provides about half the normal load.

With this arrangement, if there is a prolonged system fault the generator voltage drops and the potential transformer output approaches zero. At the same time, however, generator current will rise to several times normal. This provides a power output through the current transformer which not only will offset the loss of power, but will also give more field forcing.



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General Electric's complete line of oil-filled 55°●65° distribution transformers provides 12 percent more kva capacity—at no price increase or loss in normal operating life. This added capacity is made possible by using Permalex* insulation—a major innovation in transformer insulation systems which was developed by General Electric and is used in oil-filled distribution transformers.

The use of superior Permalex insulation permits transformer operation at higher average winding rise (65 C) without loss of normal operating life. This means you can carry 12 percent more kva with General Electric Permalex insulated transformers.

Every General Electric 55°●65° transformer has a second nameplate kva rating. The new, higher rating reflects the 12 percent kva increase—allowing you to utilize the added capacity within your established loading practices. *And the new rating retains the same design margin between stated temperature rise and actual rise—consistent with traditional General Electric distribution-transformer design practices.*

General Electric's new approach to greater kva capacity is accomplished through advanced interior transformer design. Permalex transformers retain the same small size and light weight—but with substantially increased kva capacity.

Before you buy another transformer, ask your G-E Sales Engineer to show you the story of the 55°●65° transformer. It takes just a few minutes and can save you many dollars in transformer investment and operation. Or, write for more information to Section 482-08, General Electric Co., Schenectady, N. Y.

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COMPLETE LINE OF 55°●65° POLE-TYPE TRANSFORMERS now available from G-E warehouses across the country. Instrumental in the development of this new transformer design were Dr. R. Flowers, insulation laboratory chemist and co-inventor of patented cyanoethylated kraft; J. Silverstein (front), Product Planning Specialist; and J. Leslie, insulation laboratory chemist.

Electric Utility Methods
CONSTRUCTION • OPERATION • MAINTENANCE

Magnetic Map Aids Crew Dispatching

Illinois Power Co dispatcher's magnetic map, covering the Decatur service area, improves service, cuts cost and makes crew trouble-spotting easier.

The map of the area is boarded against a metal back. Small magnets are numbered to represent the various crews. Crews radio their locations to the dispatcher's office upon arrival at a job. The girl in the office positions the proper magnets on the map at the reported location.

As the various crews continue to radio in their new locations, the magnet-indicators are positioned on the map accordingly. When a trouble call comes in, the girl can, after a quick look at the map, immediately identify and contact via radio the crew nearest the trouble.

Sleeve Spreader Reduces Fatigue

J. J. NOLAN, Supervisor, Electric Meter Shop and Laboratory, Long Island Lighting Co, Hicksville, N. Y.

Long Island Lighting Co now tests linemen's rubber sleeves with a hydraulic spreader to reduce overall test time by 25%. Furthermore, the spreader makes for high quality inspection by achieving uniform sleeve stretching throughout all the testing, while eliminating the fatigue of manual inspections.

With the manual method each sleeve was stretched many times by hand to cover the entire sleeve area. Because of variation in strength between individuals, and because of wrist and arm fatigue as testing progressed through the day, test uniformity was lost.

The new spreader, which achieves a complete and uniform inspection of both sides of the sleeve in one operation, was constructed from a standard hydraulic vise. To adapt the vise to sleeve inspection, shaped steel pipes, backed up with reinforcing plates, were welded to each of the two vise jaws. Springs and roller bearing wheels were added to the movable jaws to provide its smooth return after "spreading." Markings on the vise for each size sleeve prevents over or under stretching. The vise can be operated by foot pump or by an electrically driven compressor.

CONFIDENCE

Victor No. 729 Apparatus Insulators stand like sentinels atop this sub-station, guarding high voltage conductors and costly switching equipment.

It's your responsibility to supply power to all sorts of customers ranging from small householders to big industrials. Nothing puts the response into responsibility like insulators that won't let you down, assuring continuity of service. Power men who take their responsibility seriously depend on VICTOR Apparatus Insulators—the only insulators in the world made of **Purified Porcelain,** finest porcelain ever developed. To retain your continued confidence, we make insulators that won't cross you up—or us, either. Victor quality is not just skin-deep—it goes all the way through the complete assembled apparatus insulator. For catalog, specifications and prices contact your nearby VICTOR Sales Office. Victor Insulators Division, I-T-E Circuit Breaker Company, Victor, N. Y.

I-T-E CIRCUIT BREAKER COMPANY

PURCHASING ▶ **Purchasing function in many businesses is being upgraded.** An "Occupational Outlook" report issued by the Labor Dept says it is evident that a college degree is becoming increasingly important for promotion to high-level purchasing positions. Graduates of schools of business with courses in economics and purchasing are preferred by many employers, says the study. Others prefer men with solid technical background. There is still heavy reliance upon promoting persons into purchasing from other company departments.

Further recognition of the importance of the purchasing function is shown by bringing procurement men into top management. Some industrial firms, as well as utilities, have a vice president responsible for purchasing and related activities.

Salaries of experienced purchasing agents in 1959 ranged from $8,500 in firms with an annual volume of purchases under $3 million to $15,300 in firms with purchasing amounting to more than $30 million, according to a private survey quoted in the Labor Dept report. Beginning annual salaries for men college graduates hired as trainees in purchasing departments of large firms averaged about $5,000 in early 1960. In the federal government, beginners with college degrees usually started at $4,040 or $4,980, depending on the individual's college record. The Labor Dept study estimated there are nearly 100,000 PA's and closely related buyers employed in US industries, in public agencies, and in utilities.

PRICES ▶ **Manufacturers have withdrawn the 10% price increase** announced in June for certain types of indoor distribution equipment (EW, June 20, p 159). The proposed increase had covered such items as fusible and circuit breaker load centers, safety switches, bus duct, industrial type and molded case circuit breakers, and panel and switchboards. Recently I-T-E Circuit Breaker Co notified its distributors that it was cancelling the increase. A check disclosed that Federal Pacific Electric Co and General Electric Co were also cancelling the increase because of market conditions.

ALUMINUM ▶ **New aluminum smelting process that could affect prices** of the light metal is claimed by Aluminium Limited. Domestic producers are still trying to obtain information on the process which Aluminium says does not appreciably reduce the large power requirement but does give promise of substantial savings in other elements of production cost and in the investment required per ton of capacity.

SHIPPING ▶ **Meters ride easier by waterway** than by other means of transportation reports Bryan Gouger, mgr of purchasing and stores for The City Public Service Board of San Antonio, Texas. In a house organ article, he said waterway transportation of gas meters was cheaper and less damaging, offering annual savings to his utility of $2,000 to $4,000.

from the Panama Canal — 1912
to AEIC-EEI Cable Project — 1960

G&W DEVELOPMENT INCREASES POTHEAD RATINGS 7175 VOLTS A YEAR

Nearly a half-century ago, G&W furnished a 600 volt disconnect type pothead which was flexible enough to meet the complex demands in lock control rooms of the Panama Canal. The success of this device is a proven fact since these potheads are still supplied for service today.

Now, G&W's latest development, a 345 kv cable termination for the AEIC-EEI Project, is a significant contribution to the further progress of power transmission and distribution. Each pothead is more than 12 feet high and weighs approximately 2,000 pounds. They are designed to withstand nominal operating pressures of 200 psi and exceed the 1300 kv impulse voltage withstand specified by the project sponsors. Capacitors distribute the high-voltage uniformly along the length of porcelain from aerial lug to ground.

From the construction of the Panama Canal to the present, 48 years of continuous development by G&W have gone into one product. No more thorough job has been done by any single manufacturer. Nor is there a more complete line of potheads available than that offered by G&W. Ask your G&W representative for full details, or write us.

One of three G&W potheads installed at the AEIC-EEI Project, this unit is more than twelve feet high and weighs 2,000 pounds. If tests at 345 kv are successful, as expected, these potheads and other accessories and cable will be tested later at 450 and 500 kv phase-to-phase.

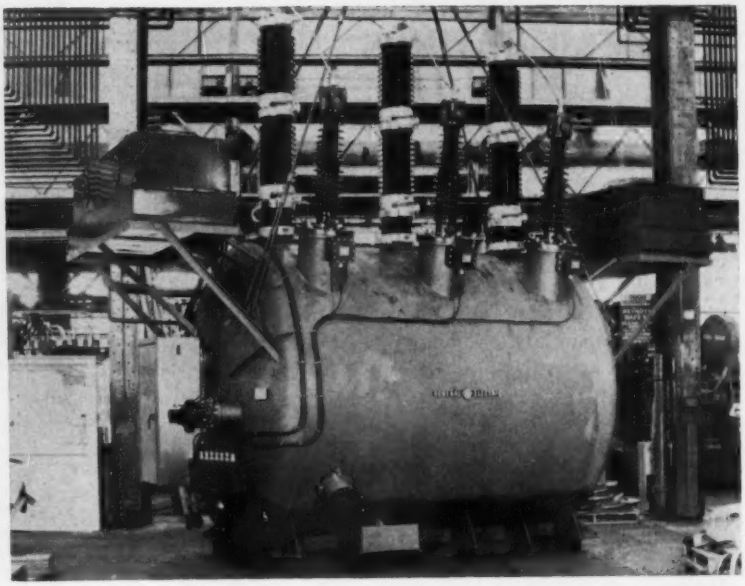
G&W ELECTRIC SPECIALTY COMPANY
3500 WEST 127TH STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES, LTD.
TORONTO, MONTREAL & VANCOUVER

superior quality standards—inspired specialized design

AT60-2

Gas-Insulated Power Transformers Developed

General Electric Co recently shipped two 12.5-Mva, 115 to 12.5-kv gas-insulated power transformers for installation in an outdoor substation of a western utility (see unit, right). Cooled and insulated by sulphur hexafluoride, they are the highest-rated of this type ever built, says GE.



Five benefits are cited by GE for gas-insulated transformers' use instead of oil-filled units of the same rating: weight reductions of from 20 to 30% because of relative weights of gas and oil; lower sound levels with gas as conductor; and due to no oil storage or handling required, need for drainage pits is eliminated. Also, because sulphur hexafluoride is non-flammable and non-toxic, expensive vaults and fire-fighting equipment are not needed. Bus duct requirements can be drastically reduced because gas-insulated transformers do not have to be installed outdoors at a great distance from the load.

Due to these advantages, GE says it anticipates that gas-insulated transformers will be used to far greater extent in downtown substations in the future. For the dense population in these areas they will provide greater safety, points out GE, and the extra-low sound level feature is also a plus.

General Electric has shipped only three other units of this kind. The first two were 2,000 kva, 69 kv and were delivered to Consolidated Edison Co in 1956; the third was 10,000 kva, 69 kv.

The company believes that gas-insulated transformers probably will prove suitable for any power transformer rating or application. Stating that this is "only a start," GE adds that it is building units of this type in various sizes, some of which are 25 Mva.

Federal Pacific Buys Canadian Transformer Manufacturer

Federal Pacific Electric Co has acquired for about $5 million in cash and stock Pioneer Electric Ltd, a Canadian electrical equipment manufacturer.

Pioneer, with headquarters in Winnipeg, has annual sales of approximately $6 million. Products include power transformers, unit substations, high-voltage switchgear, cable trays, underfloor raceway systems, industrial furnaces, electrical heating systems, and special control devices. It operates five plants in Canada: at Red Deer, Brandon, Regina, Toronto, and Winnipeg. Federal Pacific's Canadian subsidiary, FPE Canada, Ltd, operates three plants at Toronto, Granby, and Vancouver. The concern manufactures control, distribution, and power equipment.

FPE's President T. M. Cole said of the move, "The combination of these two companies will not only give us in Canada a complete product line and manufacturing plants in strategic locations, but it will also make us Canada's third largest electrical equipment manufacturer.

"Equally important in the Pioneer acquisition were advanced transformer designs and other products which Federal Pacific can produce and market in the United States."

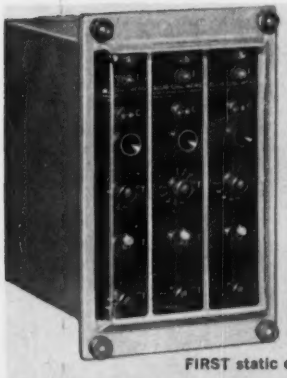
Pioneer's transformer lines consist of distribution and power transformers from 3 kva to 60,000 kva, up to 230 kv. Included are dry-types, oil-filled types, and gas-filled types, as well as associated load-tap-changing mechanisms.

Westinghouse Awarded Contracts by Con Ed, TVA

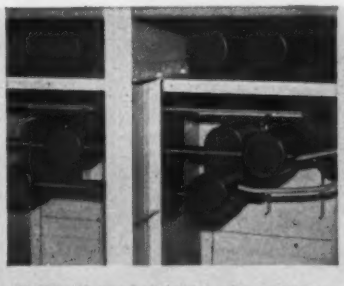
Westinghouse Electric Corp has received a contract to build two 300-Mva transformers for Consolidated Edison Co. The units will step down voltage from 345 to 138 kv, making it possible for the utility

(*Continued on page* 86)

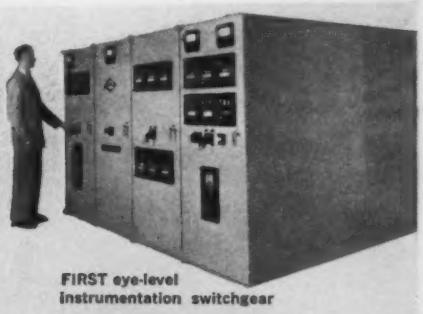
ALLIS-CHALMERS



FIRST static overcurrent relays



FIRST with track-resistant, glass polyester insulation with primary stud and bus joint

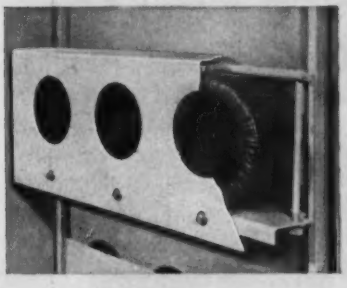


FIRST eye-level instrumentation switchgear

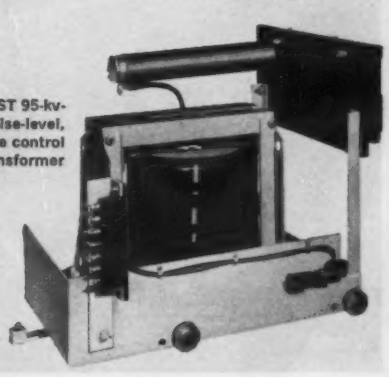
FIRST Aluma-Clad walk-in aisle switchgear

FIRST epoxy-resin potential transformers, trunnion mounted

1ST



FIRST front-access current transformers



FIRST 95-kv-impulse-level, dry-type control power transformer

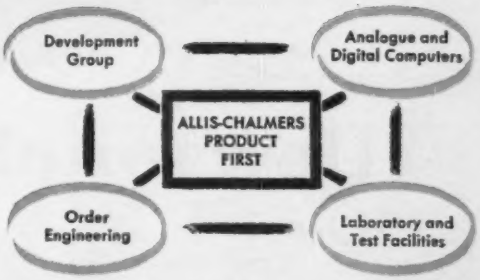
...from the company that put

Progress in Switchgear

For 113 years Allis-Chalmers has built a reputation for the finest products in the industry. A-C is continuously developing new ideas, new techniques and new products to serve you better. This same leadership spirit has quickened the pace of switchgear progress. It's responsible for the firsts illustrated above. These testify to one company's research and engineering *action*.

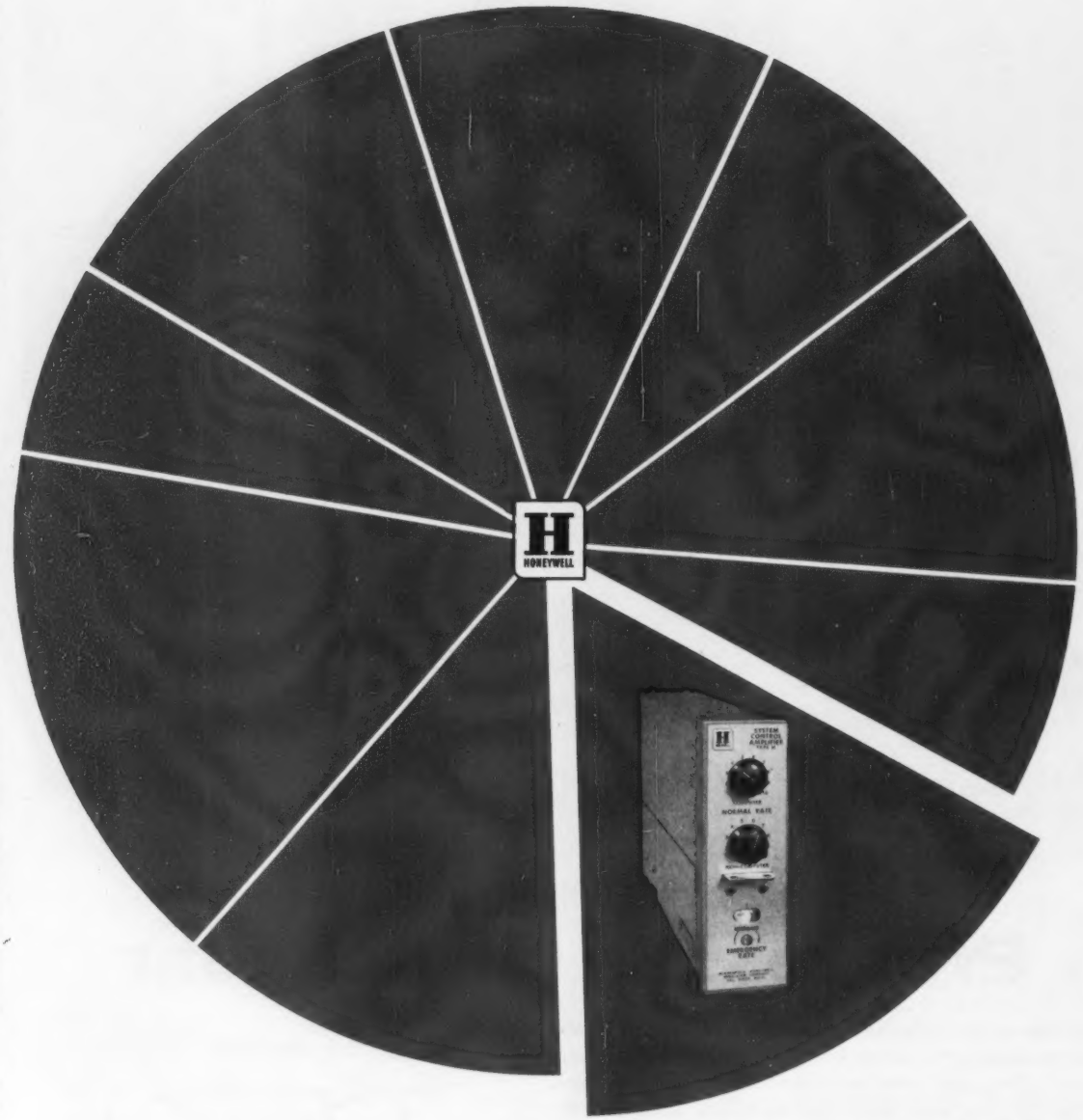
There are still better things to come in switchgear. You'll get them all when you specify better switchgear ... designed, built and *guaranteed* by **Allis-Chalmers,** Power Equipment Division, Milwaukee 1, Wisconsin. A-1357

Aluma-Clad is an Allis-Chalmers trademark.



Intradepartment teamwork bridges all gaps ... smoothly integrates information, machines and men ... speeding overall progress in Allis-Chalmers switchgear.

NEW SOLID-STATE LOAD-FREQUENCY SYSTEM



HEART OF THE SYSTEM **is this transistorized control amplifier. One basic amplifier performs various computing, measuring, alarm and control functions. Speed of response is easily changed with the turn of a knob. Six amplifiers like this can be mounted in a single standard 19-inch relay rack.**

—A MAJOR ADVANCE IN GENERATION CONTROL

Meet power demands precisely and cut generating costs with Honeywell's new load-frequency control system. It introduces solid state techniques that bring new reliability levels to automatic generation control and sharply reduce maintenance. For computer control, you can use the new Honeywell 290 industrial digital computer to mastermind the system and simultaneously compute cost data for interconnection billing.

Major components: High-speed, transistorized telemetering equipment transmits tie-line loads to the dispatcher and the command signal to generating stations. Control amplifiers perform computing, measuring, control and high and low alarm functions. Governor motor actuators control generator speeds in accordance with command signals. Rate limiters hold generation within prescribed allowances. Incremental loaders apportion generation on an economical basis.

Easy maintenance: All components are of interchangeable, plug-in, modular design, and are easily accessible while the system operates. Except for relays, *there are no moving parts in the entire system.* Slidewires, motors, gear trains, and vacuum tubes are eliminated. Use of transistors and other solid-state devices throughout cuts space requirements in half and drastically reduces heat buildup. All critical test and calibration points are compactly packaged in a single module, to provide a centralized test area and further simplify maintenance.

Honeywell's new load-frequency control system is a development of first importance in the power industry. Get complete details from your nearby Honeywell field engineer. Call him today . . . he's as near as your phone.

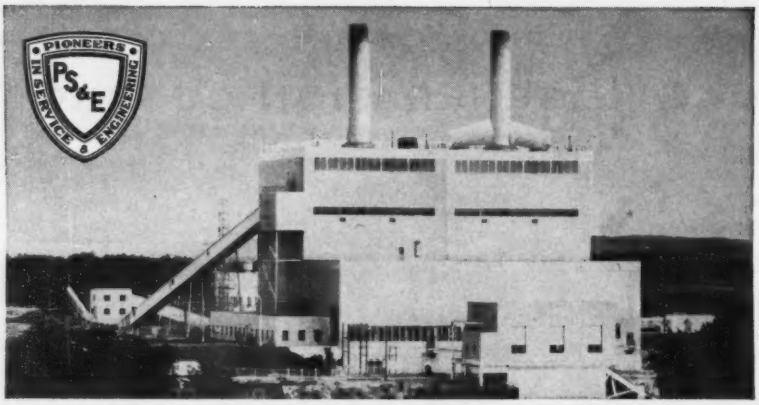
MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Penna. In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.

75th YEAR PIONEERING THE FUTURE

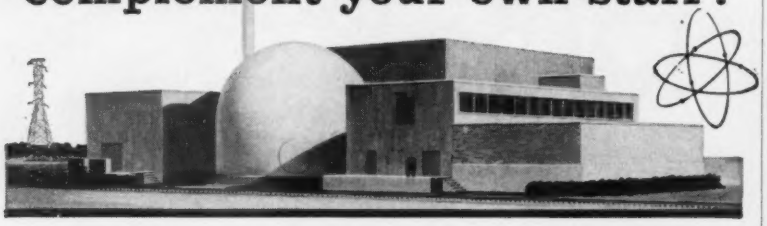
Honeywell

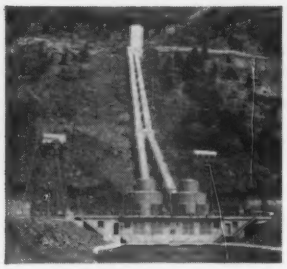
First in Control

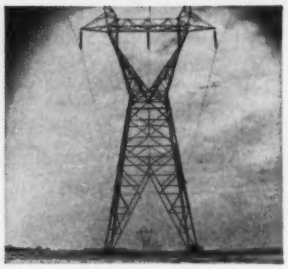
SINCE 1885



Which Pioneer service do you need to complement your own staff?







DESIGN AND CONSULTING ENGINEERING SERVICES

Pioneer specializes in designing power plants and offers design service for fossil fuel, hydro and atomic plants. It will also assist in forecasting load growth, in site selection, in purchasing and expediting of equipment and construction management. Pioneer's other services include substation, transmission and distribution studies and design.

SERVICES IN REGULATORY MATTERS

Pioneer offers its services in all phases of Federal, State and local utility regulation, including natural gas and electric rate matters, certificate proceedings, licensed project accounting requirements, depreciation studies for rate case and income tax purposes, cost allocations and special studies.

CORPORATE SERVICES

Pioneer offers its services as business and management consultants; stock transfer and dividend disbursing agents; financial, accounting and tax consultants.

Write for Booklet "PIONEERING NEW HORIZONS IN POWER"

Serving Electric Utilities and Industrial Power Users Since 1902

Pioneer Service & Engineering Co.

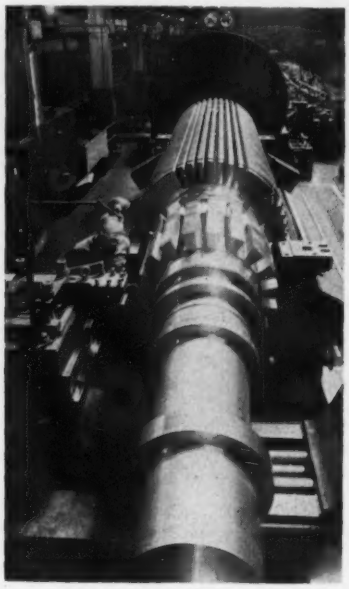
231 SOUTH LA SALLE STREET • CHICAGO 4, ILLINOIS

Westinghouse Contracts

(*Continued from page* 82)

to receive power across New York State from spots as distant as Niagara Falls.

The company also was awarded a $265,000 contract by Tennessee Valley Authority for two flash evaporators to provide boiler make-up water for Paradise steam plant. TVA engineers estimate a saving of more than $1 million will be realized by using the flash evaporators, rather than conventional submerged tube-type evaporators. This saving will result largely from additional kilowatt output and reduction in amount of coal burned, they say.

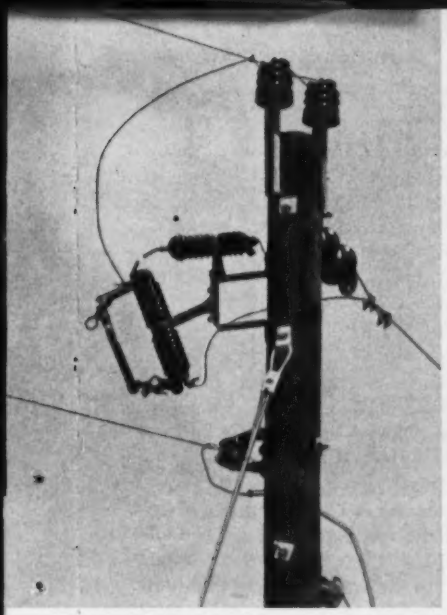


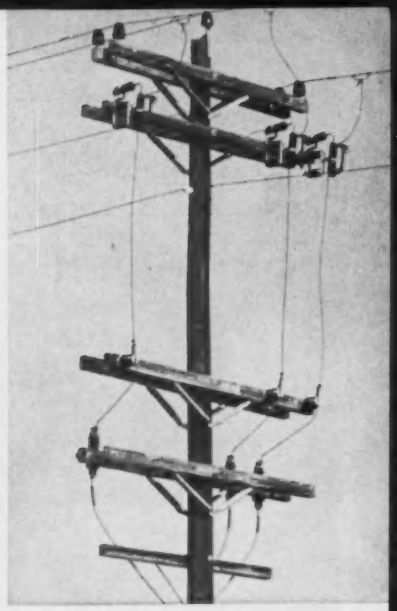
Generator Rotor Is Forged For 357-Mw T-G Set

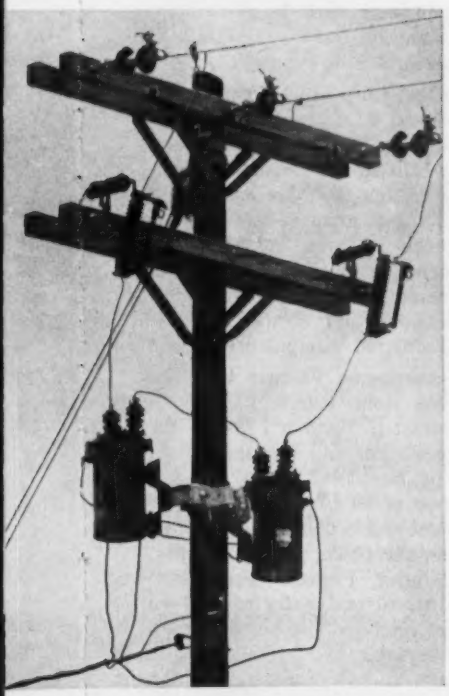
This 36-ft-long, vacuum-cast, nickel-molybdenum steel forging is being machined on a 144-in. engine lathe at Allis-Chalmers Mfg Co's West Allis works. Lathe measures 60 ft between centers.

The forging is for a 4-pole generator rotor which will be part of a 357-Mw, cross-compound, fully-supercharged turbine-generator set for Consolidated Edison Co's Astoria station. The new unit is a duplicate of the one now being installed by A-C at Astoria.

(*More News of Manufacturers, p* 88)







EXPERIENCE FOR SALE

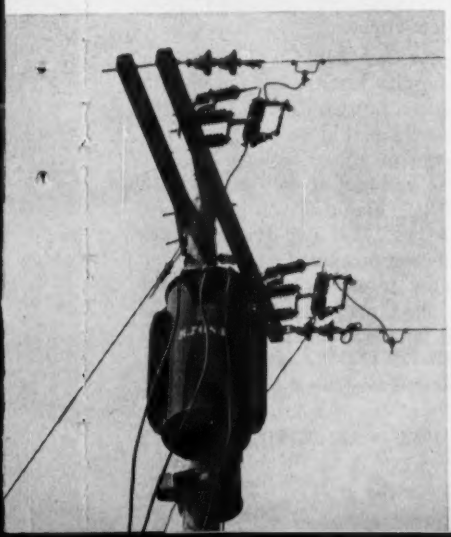
The Arrester-Cutout Combination is a Joslyn idea, born in 1939, and growing stronger each year.

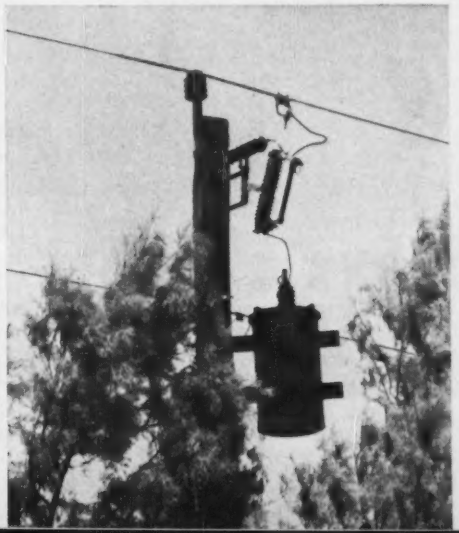
Whatever the application, if cutouts and arresters are necessary, protect with Joslyn Combination Units.

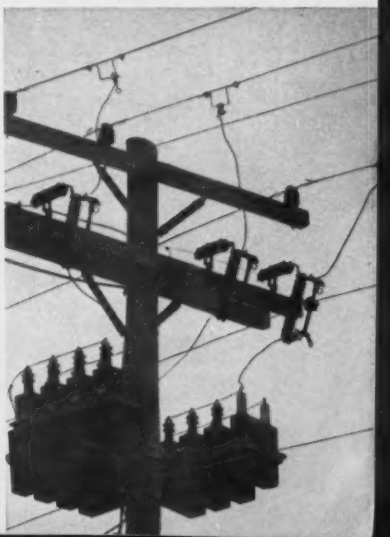
Transformers
Capacitors
Underground Cables
Sectionalizing

ONLY JOSLYN HAS ACCEPTANCE BASED ON EXPERIENCE

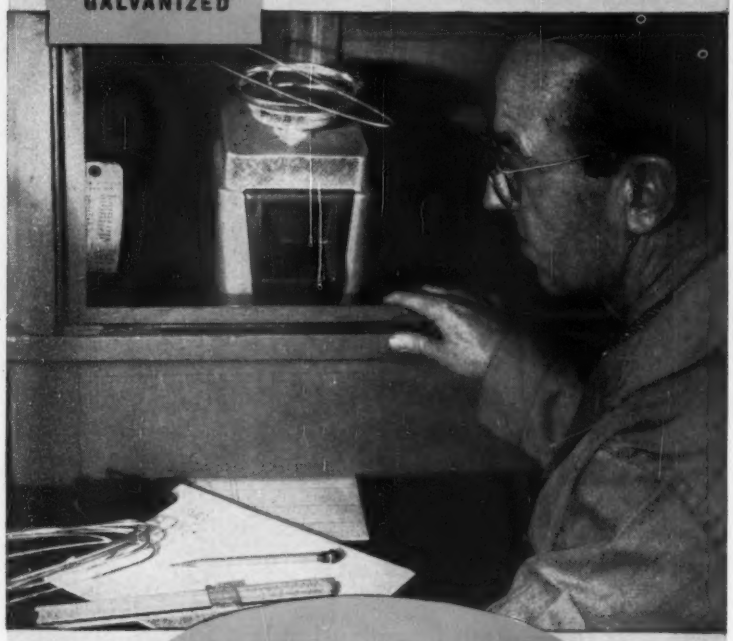
JOSLYN MFG. AND SUPPLY CO.
155 N. Wacker Drive • Chicago 6, Illinois







Crapo GALVANIZED STEEL STRAND



WEIGHT OF COATING TEST

...added assurance of dependability

The life of galvanized steel strand depends primarily upon the weight and quality of the zinc coating. The heavier the coating the longer the strand will last.

The wire used in CRAPO Galvanized Steel Strand is regularly subjected to the hydrochloric acid antimony chloride, or weight of coating, test. By means of this test the amount of zinc on the surface of the wire can be accurately measured.

This is but one of the many laboratory tests to assure consistently high, dependable quality in the finished product.

AVAILABLE IN 3 COATING WEIGHTS

CRAPO Steel Strand is regularly furnished in all standard sizes and grades and in Class A, B and C coatings. Class B coating is twice as heavy as Class A coating; Class C coating is three times as heavy.

Write for this FREE BOOKLET!

"The Story Behind CRAPO Galvanized Wire and Strand" describes and illustrates manufacturing and testing techniques. Ask for Booklet B-59!

INDIANA STEEL & WIRE CO., INC.
Muncie, Indiana

MANUFACTURERS BRIEFS

Preformed Line Products Co is spending over $500,000 to expand manufacturing and office space at its Cleveland, Ohio, headquarters. Acquisition of two three-story buildings formerly occupied by two other companies, adjacent to Preformed's main plant, will almost double production capacity.

About 38 miles of aluminum rigid conduit is being supplied by **Kaiser Aluminum & Chemical Sales, Inc,** for the Wanapum Dam development near Vantage, Wash. Engineering & Construction Co will make the installation, using conduit from 1¼ to 5 in. in dia. About 75% of the uncoated conduit will be embedded in concrete; other portions, in sections of the powerhouse and fishways where moisture is prevalent, will be exposed.

Radio Corp of America has announced it is realigning and expanding its Electronic Data Processing Division. Departmentalization was thought to be the answer to meeting greater demand for equipment. Three integrated departments have been established: commercial systems, data communications and custom projects, and industrial computer systems.

Westinghouse Electric Corp has received from Tampa Electric Co a contract to build a 175-Mw turbine-generator unit for Gannon station by late 1962. The company and two of its European associates also received a contract for a 242-Mw atomic power plant to be built near Chooz, France. The closed-cycle pressurized water reactor will be designed by Westinghouse and manufactured by Westinghouse, a Belgium and a French manufacturer. Gibbs & Hill, NYC, is architect-engineer.

Motor Coils Mfg Co of Pittsburgh is using its Epoxi-Mica Insulation system on coils of stator frames of generators of higher voltage. Until now, the manufacturer has applied it only to voltages up to 4,100 ac and 4,000 dc. Diesel-driven generators, 1,563 kva, 13.8 kv, 360 rpm, are now being processed.

Stator frame coils are insulated with glass mica tape and impregnated with solventless epoxy resin.

(*More Procurement & Products, p* 92)

NEW BULLDOG XL BUSTRIBUTION DUCT...

3 WAYS SAFER FOR PEOPLE AND PROPERTY

HERE'S THE FIRST DEAD-FRONT plug-in duct. Butyl insulation covers the full length of each silvered aluminum bus bar, *even in bus plug openings*. You get positive protection for personnel against accidental contact with "live" bars.

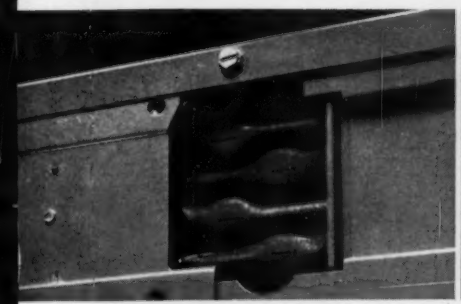
PLUG-IN SAFETY DOOR IS ALWAYS CLOSED during installation of XL Safety Plug. Interlock finger positively prevents plug installation or removal when Safety Door is open . . . and it keeps door from closing against "live" plug fingers.

THERE'S NO ARCING to endanger people or property . . . you can't plug in or unplug when the switch is "ON."

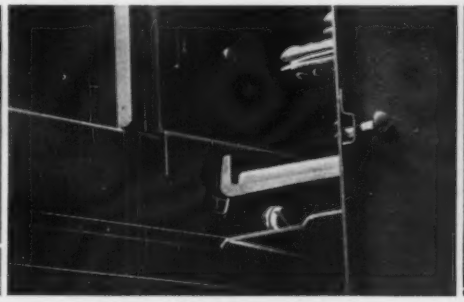
New XL BUStribution® Duct cuts down installation time . . . takes less space . . . reduces duct weight on building structure as much as 40%. Keyed bus ends slip together in a hurry while a single integral bolt locks joints securely under a ton of pressure.

Ask your BullDog field engineer to arrange for a demonstration. You'll quickly see the sales appeal of XL BUStribution Duct and matching Safety Plugs.

BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto, Ont. Export Division: 13 East 40th St., New York 16, N. Y.



IT'S TRUE DEAD-FRONT. Each silvered aluminum bus bar is full-length insulated with Butyl envelope.



IT'S A SAFETY DOOR. You can't plug in or unplug with the door open, can't close door on "live" plug fingers.

IT'S A SAFETY PLUG. You can't plug in or unplug against a load . . . safeguards personnel and equipment against arcing.

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

KEEP PACE WITH ELECTRICITY

Circuit Breaker Protection at Half the Price

PR Recloser with Circuit Breaker Control Brings Significant Savings

Exclusive 220-volt control in the Westinghouse PR Recloser makes possible the application of conventional CO relays. This provides the flexible accurate service of an oil circuit breaker at the low, low cost of a recloser.

A number of relay schemes are readily applied to the PR Recloser. Standard timing devices, including the series trip coils, are replaced by either an a-c or d-c shunt trip coil. Multi-ratio bushing CT's are added to the recloser's condenser-type bushings in the same manner as with circuit breakers. A weatherproof relay cabinet is then mounted on the recloser's galvanized substation frame as illustrated.

The standard PR reclosing mechanism provides the same range of flexibility available with *reclosing relays.*

Recloser accessories include: manual test switch, auxiliary switches, sensitive ground tripping schemes, lockout indicating switch, capacitor trip device, thermal demand or indicating ammeters, and others.

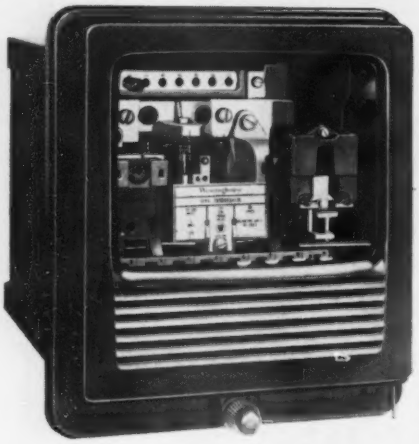
Ask your Westinghouse sales engineer to show you how to get high-quality oil circuit breaker protection for slightly more than the cost of a standard recloser. Or write today to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa.

J-61000

◀ Standard swinging relay panel contains control switch with red and green indicating lights, a nonreclosing switch, a ground fault bypass switch and circuit breaker protection of the control circuit. Space is available for at least seven additional control devices such as: Type CO overcurrent relays, Type CO ground fault relay, and indicating instruments such as demand meters, miniature ammeters, watthour meters. Reverse current relays can also be applied.

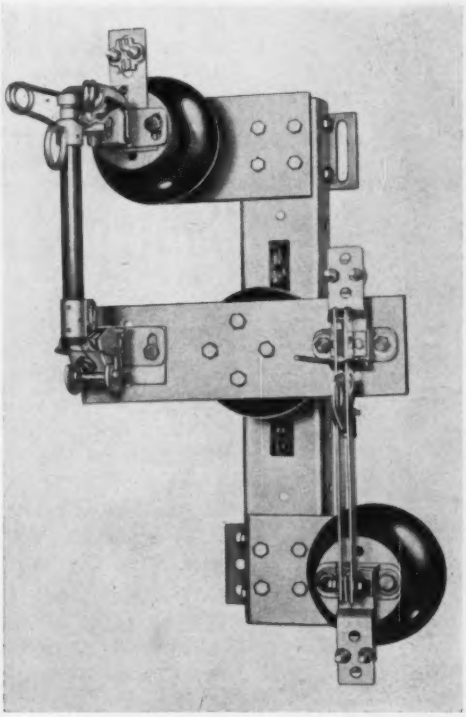
you can be sure . . . if it's

Westinghouse



Relay . . .

. . . protects against excess or reverse power flow. Single and 3-phase type CW relays, which do not require external reactors, are available for 120 or 208-v applications. The tap block at the top permits a selection of power settings from 20 to 120 w. Time delay is adjustable. The one-piece frame is of die-cast aluminum.
Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.



Fuse-Switch Tandem . . .

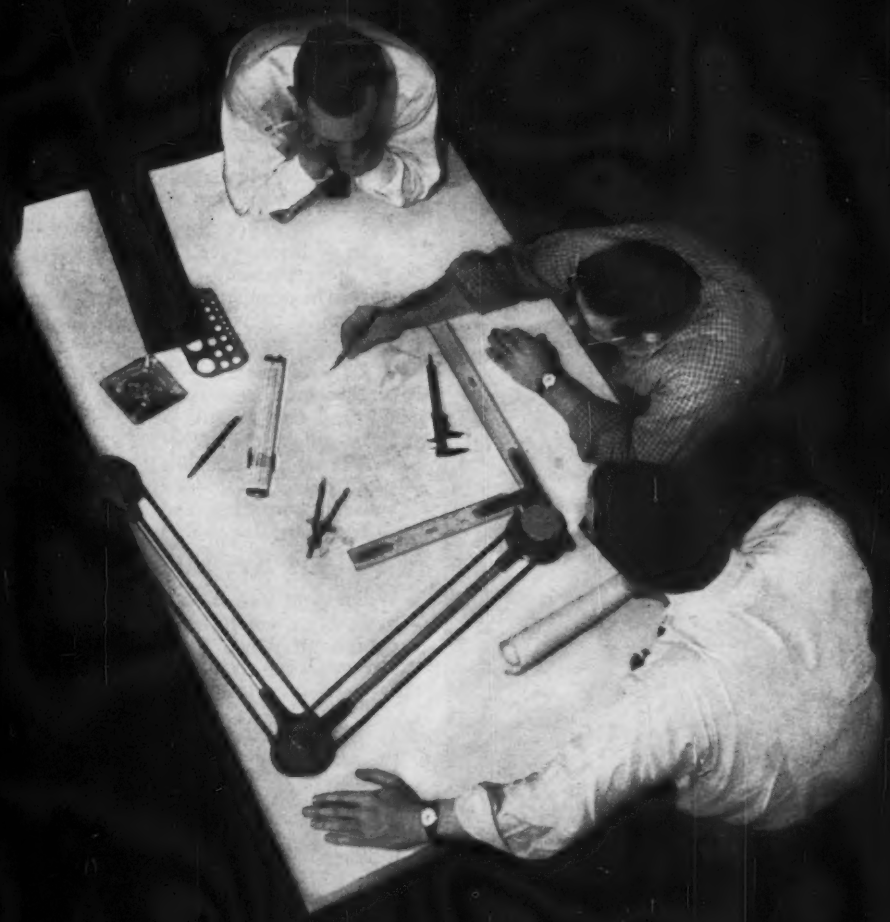
. . . for bypassing breakers and reclosers is offered with either left or right-hand offsets to meet substation or pole structural needs. Switch and power fuse tandems in 7.2, 14.4 and 23-kv ratings are furnished in three combinations of type HDO or HXO fuses with type DP or PES switches.
Line Material Industries, Milwaukee 1, Wis.

Oil Cutouts . . .

. . . for 7.8 and 15-kv circuits carry 200 amp. The 7.8-kv cutout has a 5,000-amp interrupting capacity. The other, rated at 7,000-amp interrupting capacity, is small and lightweight. Metal enclosures are standard, but special assemblies as well as gang-operating mechanisms are available.
General Electric Co, Schenectady 5, N. Y.

(More New Equipment on page 96)

CONCENTRATION



RT&E was founded and operates today on a very basic premise: do one thing and do it better than anyone else. That's why you'll find engineers at RT&E thinking and doing things with transformers that nobody else has ever done . . . why engineering talent at RT&E is concentrated on *one* idea . . . a better transformer. This concentration can pay off for you. Proof? Write for Bulletin 101.

RT&E Corporation · Waukesha, Wisconsin · Portland, Oregon · Arlington, Texas

PREFERRED

program to provide

General Electric introduces *PREFERRED LIGHTING* —a new program offering *exceptional customer service* on outdoor-lighting systems.

With *PREFERRED LIGHTING* you get a full selection of fast-moving equipment—equipment most preferred on a national basis as evidenced by present purchases—plus application analyses combining the latest lighting trends and the most economical and effective ways to do specific lighting tasks.

In addition, *PREFERRED LIGHTING* makes possible exceptionally fast delivery of street-lighting systems. On products of our own manufacture, equipment is usually in your hands in one to three days after receipt of your order.

General Electric offers you the widest variety of equipment necessary to meet your general and special lighting needs. But, your optimum use of the "customer-selected" *PREFERRED LIGHTING* systems will bring the immediate benefits of superior product performance . . . one-to-three-day delivery . . . easy selection, ordering, and application . . . all adding up to top value for your lighting dollar.

PROVED EQUIPMENT PERFORMANCE

When you select G-E *PREFERRED LIGHTING* equipment you'll know you are buying the type of equipment which has proved most popular with customers all across the country—*preferred* by a majority of customers for performing the same lighting tasks

PROVED PERFORMANCE results because General Electric *PREFERRED LIGHTING* represents customers' choices of the best in filament, mercury, and fluorescent lighting. Only 148 catalog numbers (5000 are available) meet 95% of all roadway lighting needs.

QUICK DELIVERY—one-to-three-day delivery is maximum for most General Electric *PREFERRED LIGHTING* equipment including pole anchor rods and base templates. Poles can be ordered for one- to four-week shipment, allowing time for curing concrete bases prior to installation.

LIGHTING... a new General Electric more light per dollar on America's roadways

you are interested in solving. These systems have met the test of customer evaluation in terms of cost of light, and over-all operating and maintenance economy ... *your best guarantee of a modern lighting installation.*

ONE-TO-THREE-DAY DELIVERY

With *PREFERRED LIGHTING,* you can reduce your inventory investment. Much of your warehousing and inventory expense is borne by General Electric.

A simplified product line, pre-designed lighting systems and layouts, and the ability to order from a single source mean you can order most lighting equipment by phone. What's more, in most cases you can expect to have your equipment at the installation site within one to three days of your order!

SIMPLIFIED SELECTION AND APPLICATION

General Electric's new *PREFERRED LIGHTING* Designer's and Buyer's Guide is a compilation of all pertinent data you need to select, order, and apply complete lighting systems or components.

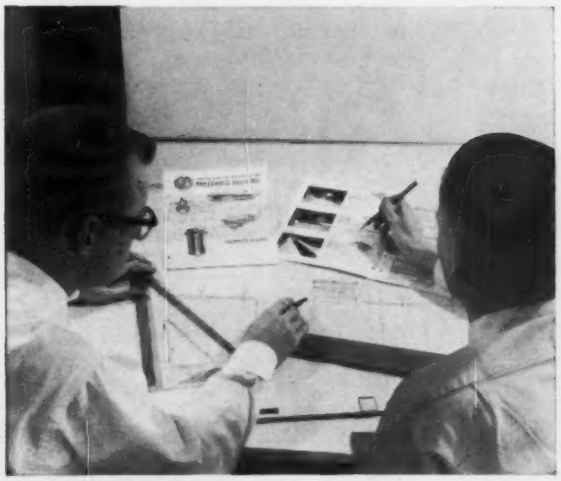
By following "customer-approved" *PREFERRED LIGHTING* recommendations, you save the time and expense of individual lighting layouts and calculations. Factors such as distribution patterns, spacings, mounting heights, and maintenance factors are already worked out in advance. Just select the type of lamp and the footcandle level you desire.

PREFERRED LIGHTING IS AVAILABLE NOW

Get your *PREFERRED LIGHTING* Designer's and Buyer's Guide, today! Use it as a basis for a thorough evaluation of your present buying practices, in comparison with the benefits offered by General Electric's *PREFERRED LIGHTING* approach. Your G-E Apparatus Sales Engineer or Agent will be happy to help. General Electric Company, Outdoor Lighting Dept., Hendersonville, N. C.

Progress Is Our Most Important Product

GENERAL ELECTRIC



EASY APPLICATION saves you the time and expense of designing individual layouts, and considering distribution patterns, spacing, mounting heights, and maintenance factors. Selection of *PREFERRED LIGHTING* equipment is a simple matter of deciding on source and footcandle level.

New PREFERRED LIGHTING Guide

General Electric Company
Section E460-02
Schenectady 5, New York

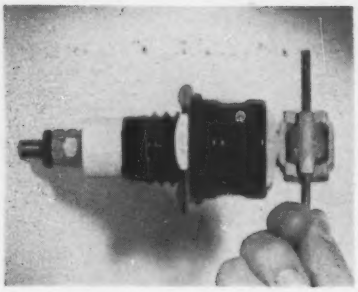
Please send me a copy of the new General Electric *PREFERRED LIGHTING* Designer's and Buyer's Guide, GEA-7100, with descriptive, application, and ordering data on the complete line.

Name _____

Company _____

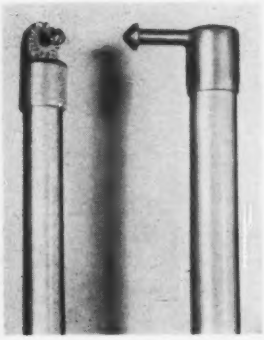
Address _____

City _____ State _____



Transformer Bushing . . .

. . . for potentials to 1,200 v is readily mounted by screwing a steel retaining nut onto the end that projects into the transformer. Two tin-plated bronze terminals available accommodate wire sizes No. 8 to aluminum equivalent No. 4/0. The high-voltage porcelain body is grooved to prevent twisting.
Lapp Insulator Co, Inc, Le Roy, N. Y.

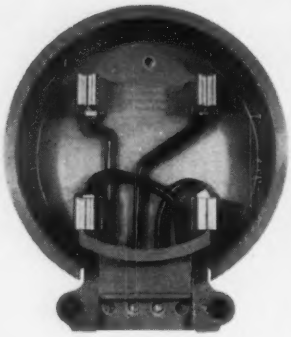


Hot Sticks . . .

. . . of fiberglass have high strength and rigidity and resist water penetration. Glastrux sticks are available in dia from 1¼ to 2½ in. and lengths to 20 ft. Present heads on wood sticks can be reinstalled on these fiberglass sticks.
Bodendieck Tool Co, Taylorville, Ill.

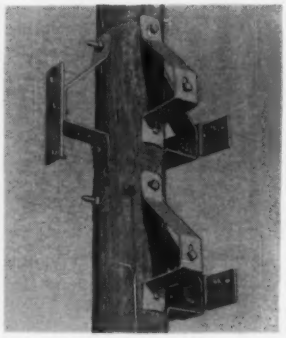
Cable Tester . . .

. . . detects poor insulation and pinpoints its location. The unit, which supplies up to 350 kv dc, can be used to burn out the potential failure. It furnishes pulses to 80 kw at 16 or 8 kv. Identifying cables and determining phase relationships are among other functions it performs.
Sorenson & Co, Div of Raytheon Co, Waltham 54, Mass.



Meter Adapters . . .

. . . fit standard meter enclosures. They enable installing "S" type watthour meters as replacements for "A" type and older ones. The adapters of reinforced fiberglass are fire and moisture-resistant, non-corrosive and tamperproof. A 3-wire adapter is shown.
Ekstrom Electric Controls, Inc, 18275 Weaver Ave, Detroit 28, Mich.



Mounting Brackets . . .

. . . support clusters of transformers, capacitor banks, or line-type oil circuit reclosers. For mounting three 167-kva transformers, Minit-Mount brackets call for only four through-bolts in a pole. Clusters supported by 9-lb Minit-Mount brackets leave generous working space. Branches of **Graybar Electric Co.**

Computer Keeps System Costs Minimized

(*Continued from page 67*)

the function generator for each unit. The function generator has set into it an analog which converts dH/dP values to unit desired generation. Unit desired generation values are added to give station desired generation. Station desired generation minus actual generation is the station requirement and when this sum equals the area requirement, the lambda servo is in a balanced position and stops moving. Raise impulses from the master controller are sent to each station having a raise requirement until the units increase generation and reduce the unit, station and area requirement to zero. This continuous process keeps tie-line flows on schedule and at the same time maintains the units at the value of generation resulting in minimum costs.

This is VEPCo's third device for controlling generation; the first tie-line load control equipment was installed in 1952, when the number of interconnections grew to five. The scheme provided telemetering of megawatt flow from the five interconnection tie points to the System Operator's office. Only two steam stations were controlled, based on the philosophy, current at the time, that load swings should be taken on the older, high-cost units.

A few years later the original console was replaced with a newer type which provided control for six stations and space to ultimately provide for control of eight. Seven stations are now controlled. By controlling seven stations, a much wider regulating range was obtained. The range changed from about 20 Mw to 150 Mw and improved the control of tie line flow. Also, the controlled stations could be maintained at equal incremental production cost with the improved control.

The final step was the Desired Generation Computer to take transmission losses into account. The new unit was designed to use existing telemetering and local control channels and to work alternately with the existing console. If the computer is needed for study purposes or maintenance, the console can be used in its place.

GULF STATES NEW WILLOW GLEN STATION....

TAILORED TO TOMORROW

BY STONE & WEBSTER

With power demands in their territory among the fastest-growing in the nation, Gulf States Utilities Company called upon Stone & Webster Engineering Corporation to design and construct the Willow Glen Station at St. Gabriel, Louisiana, comprising an initial 162,000 kw unit.

Drawing its cooling system water from the Mississippi, the new station has been designed for future conversion to coal and employs the most economical application of the current art of automation. Willow Glen was completed in April, 1960 . . . on schedule and within budget estimates.

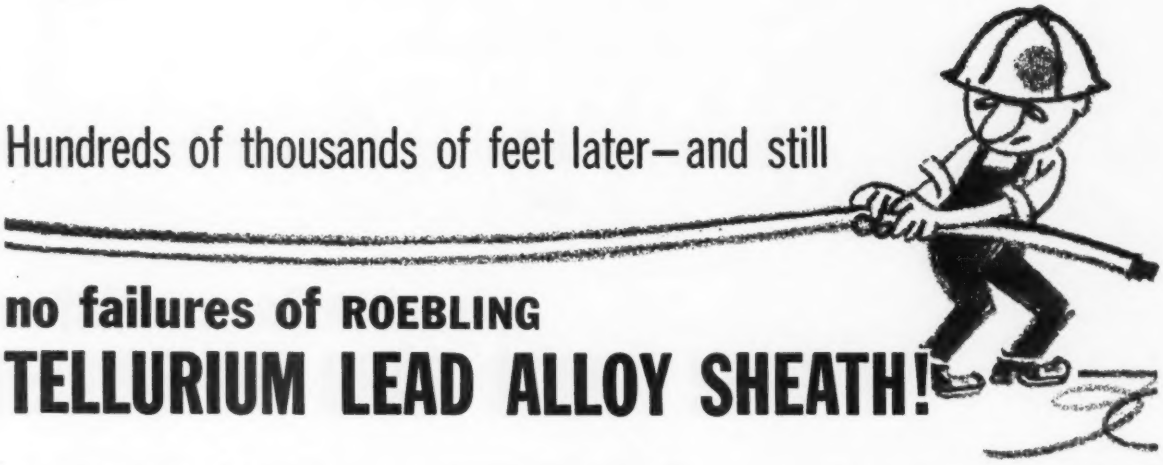
Stone & Webster's knowledge and skill in the power field can benefit your next project. Call or write our nearest office.

STONE & WEBSTER ENGINEERING CORPORATION

A Subsidiary of Stone & Webster, Inc.

New York • Boston • Chicago • Pittsburgh • Houston • San Francisco • Los Angeles • Seattle • Toronto

Hundreds of thousands of feet later—and still



no failures of ROEBLING TELLURIUM LEAD ALLOY SHEATH!

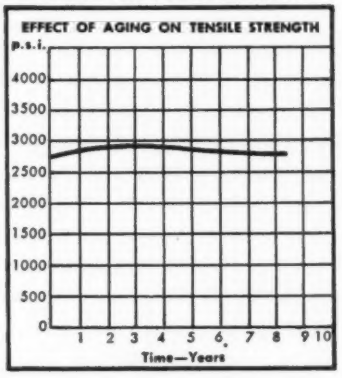
More proof: Tensile strength and elongation remain virtually unchanged, after eight years aging.

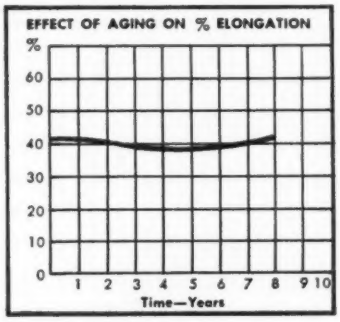
The first Roebling Paper Power Cable with the extraordinary Tellurium Lead Alloy Sheath went into service over five years ago. Since then hundreds of thousands of feet have been put to work. The record? Not a single failure! This remarkable record of service on energized circuits proves conclusively that Roebling Paper Power Cable with Tellurium Lead Alloy Sheath gives you maximum service, with maximum savings!

What's more, we asked the people who bought this cable to put it into the toughest service possible—in such installations as high risers, grades and underground installations where large cable movements and high temperatures prevail. And this gruelling service bears out what we've always maintained: Roebling Tellurium Lead Alloy Sheath has long term stability when it comes to tensile strength and elongation, high resistance to creep and bending fatigue.

These graphs of laboratory tests show effect of aging on tensile properties of Tellurium Lead Alloy Sheath.

TELLURIUM LEAD ALLOY SHEATH...



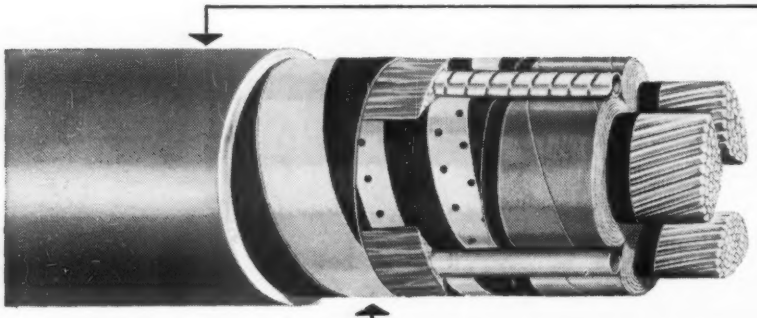


The exceptional quality of this sheath is one reason why Roebling has more Tellurium Lead Paper Power Cable in service than any other manufacturer. *Another* reason is the superb *inner* quality of this cable. Every step of construction represents scrupulous care. The paper tapes, for instance, are applied under uniformly controlled tension, to assure maximum insulation qualities. And every inch of the cable is tested—then tested again.

You benefit in all kind of savings—not the least of which is *money*—when you put Roebling Paper Power Cable with Tellurium Lead Alloy Sheath into service! Don't you owe it to yourself, and your company, to find out more? An interesting, profusely illustrated book is yours free. Write for your copy ...right now! Ask for Technical Bulletin 205-C. Roebling's Electrical Wire Division, Trenton 2, New Jersey.

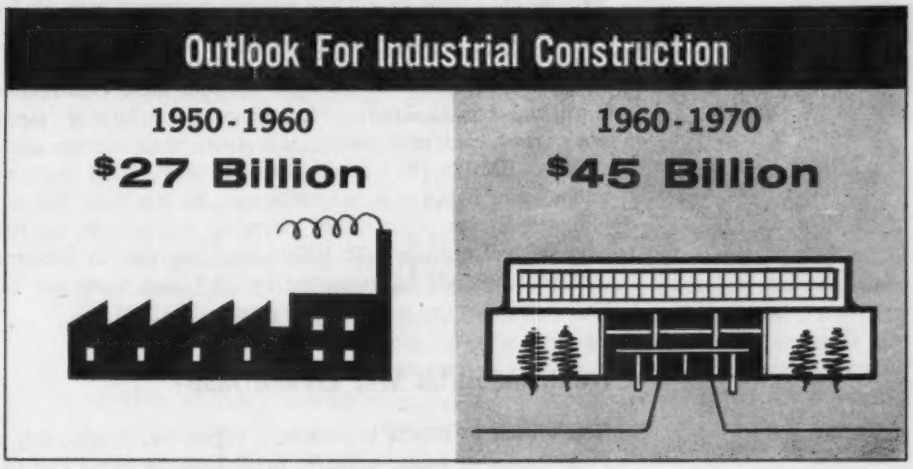
ROEBLING

Branch Offices in Principal Cities
John A. Roebling's Sons Division
The Colorado Fuel and Iron Corporation



Uniform physical properties are easily achieved in a single operation with the tellurium alloy. This unique feature is but one of several which distinguish the tellurium alloy from other fatigue-resistant lead alloy sheaths.

Mammoth new taping and cabling machines, and the finest obtainable materials, are used to produce the carefully constructed "heart" of Roebling Paper Power Cables.



Source: McGraw-Hill Economics Department

Ten-Year Spurt for Plant Construction

Report on
Electrical Business Outlook

US manufacturers will lay out $45 billion for new plants and warehouses during the 1960's, according to the latest report from McGraw-Hill's Economics Department. That's two-thirds more than they spent for new plants in the Fifties. For many utilities, these big outlays will mean substantial growth in industrial load—a demand that already accounts for about 50% of the industry's kwhr sales. Here's the ten-year outlook.

- **Not all utilities will benefit equally.** Much of this new construction will go up in the South and Southwest, and in other regions where population and incomes are rising most rapidly.
- **Many companies will expand their plants to turn out more new products.** This generally leads to better than average industrial load growth.
- **Smaller plants will get more emphasis** than they have previously.

After two sluggish years, industrial construction is showing some vigor. After tumbling from a record $3.6 billion in 1957 to $2 billion last year, new plant construction is now definitely on the upswing. Nevertheless, industrial building put in place this year will amount to only $2.7 billion—not very impressive alongside 1957's $3.6 billion record. But looking further ahead, the outlook is bright. Very much so.

How Plant Construction Boosts Load Growth

Industrial load and industrial construction rise together. As a matter of fact, we can read the increase of either from the Federal Reserve Board Index of Industrial Production. Statistics from the 1950's show that an additional $500 million worth of industrial building accompanied each one-point advance of the FRB Index (revised basis, 1947-49=100). Assuming this relationship continues, gains in industrial construction in the Sixties will be far more impressive than in the Fifties. That's because (1) We entered this period on a higher base, 168 on the

FRB scale compared with 113 in 1950, and because **(2)** Industrial growth is expected to be somewhat faster in years ahead (4.5% a year against 4% a year in the Fifties).

The FRB Index will advance nine points per year over the decade, according to McGraw-Hill forecasts. Outlays for industrial building, hence, will average $4.5 billion a year (9 x $500 million) compared with $2.7 billion a year during the Fifties.

And industrial load will go right up with these construction outlays. Actually, it will rise somewhat faster. New plants tend to be more mechanized, more automated. Thus, each new plant adds a greater than average amount of load to power systems. Back in 1957, a one-point rise on the FRB Index brought with it a 1.67 billion kwhr increase in industrial use. By last year, that figure had risen to 1.8 billion kwhr per point. And, extending this growth, by 1970 each single point advance will mean a 2.55 billion kwhr increase in industrial use. That means industrial use will be increasing by 23 billion kwhr per year by 1970. That's almost twice as fast as the yearly gains since 1955.

Which Industries Will Expand Most?

Here's what to expect in industrial expansion, barring any major shifts in consumer tastes or major scientific breakthroughs, according to McGraw-Hill economists Douglas Greenwald and Alfred Litwak.

• **The nonferrous metals, instrument, and machinery industries** (above-average to light power consumers) will step up their plant construction considerably.

• **The high power-consuming chemical process group**—chemicals, paper and pulp, glass, rubber, and cement manufacturers—are likely to spend at above average rates for new plants in the 1960's.

• **Food and textile producers,** fairly heavy power consumers, are planning to increase their plant capacity at about the average rate for all manufacturing.

• **In the transportation equipment industry,** on the other hand, excess capacity is a critical problem. Their plant expansion in the near future is likely to be only moderate. These industries are fairly light power consumers.

• **Similarly, in autos, excess capacity rules out major additions** to plant in the near future. US auto firms can now turn out more than 10 million cars a year—clearly more than they'll be called upon to produce for some time. The auto-makers are moderate power consumers.

• **Petroleum refiners now plan to increase plant capacity by only 1%** a year during 1960-1963. At that rate, the oil companies, heavy power consumers, will be adding very little to the volume of industrial construction.

How New Products Will Shape Construction Plans

Industry is spending $9.6 billion for research and development this year, and already has plans to increase R&D outlays to $11 billion by 1963. The implication is clear—from this investment will come a steady flow of new products. And new products can change industrial construction needs.

By manufacturers' own estimates, new products will account for 12% of sales by 1963. And if manufacturers continue to push their R&D efforts, and chances are they will, a full third of their sales by 1970 will be in new products—products not currently produced. This means greater construction outlays for the future. The record shows plant construction for turning out new products requires substantially greater outlays per unit of capacity added than does expansion of plants to produce existing products.

This heavy flow of new products will call for more expansion in some lines of manufacturing than in others. New product sales will be particularly important for the machinery and electrical machinery producers. They expect new products will account for 40% and 50% of sales, respectively, by 1970. And new products will be almost as important in future sales of chemicals.

The chemical industry, for example, aims to capture a substantial portion of the building materials market with new plastics. By 1970, according to some chemical industry forecasts, plastics will account for 25% to 30% of all building materials sold. Similarly, aluminum is stepping up its efforts to capture construction markets long held exclusively by steel.

Then There Is Changing Population and Income . . .

The population shift from our older cities to the fast growing urban areas of the South and Southwest has been one of the most striking developments of the postwar period. The 1960 census showed that eight of the 10 largest US cities actually decreased in population in the 1950's. But it also showed dramatic growth in other areas—Arizona's population increased 71%, California's advanced 47%, while Florida's population gained 77% and Nevada's, 76%. In contrast, the national average increase was only 17.5%.

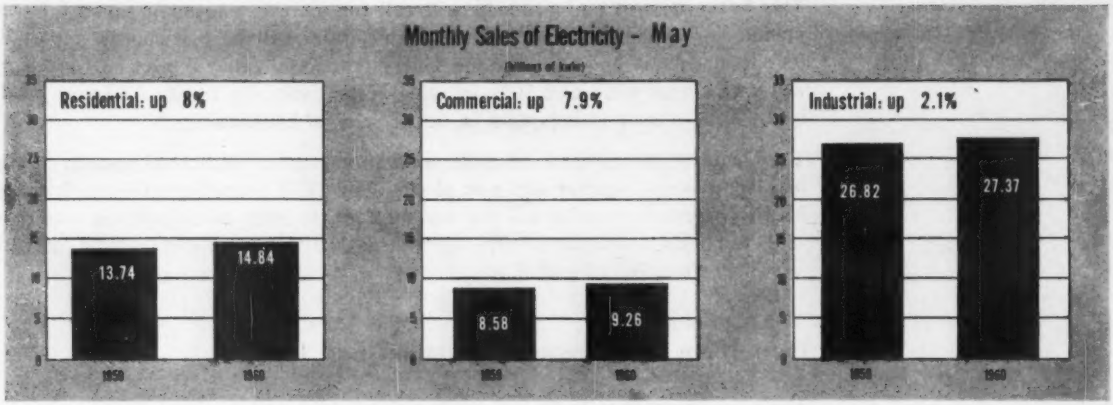
With these dramatic shifts in population go important shifts in markets for consumer and producer's goods. These shifts carry with them a need for new industrial plants—many more in some areas than in others. While population in some states has burgeoned, population in many others is growing slower than average. A few states are actually suffering a decline.

Rising incomes, and redistribution of incomes, too, will have a pronounced effect on industrial construction in the Sixties. Family incomes (in constant dollars) will increase about 25% to 30% over the decade. Compare that with a 17% gain in real dollars during the Fifties. And recent trends in income distribution indicate many more families will be in the $10,000-a-year and over bracket (the figure is presently 14.2%). Thus, we may expect a growing emphasis on new plants to turn out luxury goods. The pleasure boat industry reflects this recent trend.

Meanwhile, regions that have traditionally lagged behind in income are catching up as they shift from an agricultural to an industrial economy. In the process, average incomes in these areas are rising. New building will thus be attracted to the Southeast, the Southwest, the Plains, and the Rocky Mountain states—all of which are improving their relative income positions, and thus their demand for goods.

The expanding national highway system will also play an important role in manufacturers' decisions on new plant sites. Many industries are no longer restricted by the availability of rail facilities. Auto and truck transportation has changed that. Plants can be built along highways, now, within easy reach of labor and consumer markets. Workers can travel to their jobs by car. Goods can be shipped quickly and cheaply by truck. Plants, consequently, can be located closer to final markets, and their capacity can be limited to local market demands. Already, these trends have been reflected in industry's decentralization. Smaller plants are growing in number.

Traffic congestion, too, plays a role in plant size and location today. Smaller plants mean fewer parking problems; less traffic congestion as employees enter and leave work. Also, experience has shown that bigness does not assure efficiency. In fact, beyond a critical point the efficiency of a plant is likely to decline drastically. For all these reasons, firms will prefer to build a larger number of small sized plants, and build them in growth areas, during the 1960's.



Power Statistics

		Latest Month	Year Ago	Annual Change %
Capacity	May	161.28	148.03	9.0
Dec. '59 Peak (million kw)		121.6	113.5	7.2
Est. Dec. '60 Peak	May	133.7	134.3	– 0.4
Production—billion kwhr	May	60.34	57.66	4.6
Hydro		13.04	11.74	11.1
Fuel		47.30	45.92	3.0
Sales—billion kwhr	May	54.54	52.09	4.7
Residential		14.84	13.74	8.0
Commercial		9.27	8.58	8.0
Industrial		27.37	26.82	2.1
Other		3.07	2.92	3.7
Fuel Consumption	May			
Coal—million tons		13.38	12.95	3.3
Oil—million barrels		5.05	5.79	–12.8
Gas—billion cu ft		151.72	151.05	0.4
Net Income Class A & B Co's—$ million	May	131.41	124.36	5.7
Residential Customers—millions	12 mos.	49.36	48.17	2.5
Revenue per kwhr	ended	2.48¢	2.52¢	– 1.6
Avg kwhr per customer	May. 31	3,689	3,437	7.3
Avg annual bill		$91.63	$86.61	5.8

Business Statistics

Indexes: 1947–49 = 100				
FRB Industrial Production	June	166	167	– 0.6
ENR Construction Cost	Aug.	174.0	169.9	2.4
BLS Cost-of-living	June	126.5	124.5	1.6
New Orders for Machinery (1950 = 100)	June	186	175	6.3
NEMA Sales				
Insulation materials	May	134	153	–12.4
Electric appliances		90	106	–15.1
Wholesale prices				
Motors and generators	May	141.8	146.7	– 3.3
Transformers and regulators		144.1	148.9	– 3.2
Switchgear and fuses		175.3	177.4	– 1.2
GNP—annual rate—$ billion	1st qtr.	498.0	470.4	5.9

Significant changes: McGraw-Hill's Index of New Orders for Machinery continued to advance in May for the second month in a row. Once more it registered a new high for the year—a healthy sign.

Low Humidity Cuts Air Conditioner Sales

Dealer sales lag while national figures are good; manufacturers gear for pick-up in end of summer sales

"It's not the heat, it's the humidity" has been the byword for air conditioning dealers across the country this summer.

While it has been hot in many parts of the country, the humidity just hasn't been what it should be to spur air conditioning sales.

In Louisville, Ky., one dealer said, "Air conditioners are an impulse item. It's like turning on hot and cold faucets. People buy air conditioners when they need them."

A round-up by *Electrical Merchandising Week* showed that it's the humidity which affects air conditioning sales. Commented one dealer recently, "Like last weekend it was hot, but no humidity. We sold fans, not air conditioners."

One national news magazine which has been following air conditioner trends feels that there will be late summer bargains in room air conditioners. The reason: Sales are lagging as a mild summer and moderate humidity across most of the US keep buyers comfortably at home.

Utilities have already started their push. At Georgia Power Co a newspaper ad noted that all 1960 models were marked down for clearance with the added admonition, "Plenty of hot weather left! Buy now and save."

Manufacturers, unlike dealers, were optimistic.

Industry factory sales of packaged units for June reached 49,000 units—the highest monthly total ever recorded. There were 33,000 residential and 16,000 commercial packaged units sold.

For the first five months of 1960 room air conditioner sales totaled 888,000 units (see table below). Last year's figures showed that 971,000 units were sold in the first six months of 1959, indicating totals through June this year may surpass that figure.

Residential packaged unit and commercial packaged unit sales through May are also shown in the table. Latest figures show that 140,000 residential and 70,000 commercial units were sold as of the end of June. This compares with 114,400 residential and 73,300 commercial units sold in the first six months of 1959.

Last year in June, 26,800 residential packaged units were sold plus 17,200 commercial units. This June the totals were 33,000 residential and 16,000 commercial, an increase for residential units, while commercial were down.

Westinghouse Electric Corp's Air Conditioning Division at Staunton, Va., had to cancel its one-week vacation shutdown last week because sales have been so good, indicating there may also be a pick-up in dealer sales. Since the first of the year Westinghouse sales have increased 26% compared to the same period last year.

Commenting that usually the shutdown is made with a minimum of interruption in shipments, R. K. Serfass, division manager, said, "The change in practice was necessary this year as a result of the high level of sales being received through the division's distributor organization."

York Division of Borg Warner Corp reported that June shipments were 15% ahead of last June and volume to the first six months was 18% above the same period in 1959.

Industry Factory Sales

	Room Air Conditioners	Residential Packaged Units	Commercial Packaged Units	Totals
1956	1,828,365	132,295	122,108	2,082,768
1957	1,586,094	127,464	89,578	1,803,136
1958	1,673,295	144,130	86,411	1,903,836
1959	1,625,800	207,000**	120,500**	1,953,300
1960*	888,000**	110,000**	55,000**	1,053,000

* First five months
** Estimated

Breakdown of Packaged Units

Air Conditioners
(Integral and remote condenser-type located within one space)

1956	155,356
1957	115,992
1958	93,978
1959	107,900*
1960	52,400**

Year-'Round Units
(With furnace built-in)

1956	13,541
1957	7,445
1958	11,973
1959	12,900*
1960	5,500**

Heat Pumps
(Both self-contained and split systems)

1956	4,746
1957	10,163
1958	25,461
1959	41,700*
1960	18,500**

Split Systems
(Cooling only)

1956	80,769
1957	83,442
1958	99,129
1959	165,000*
1960	88,400**

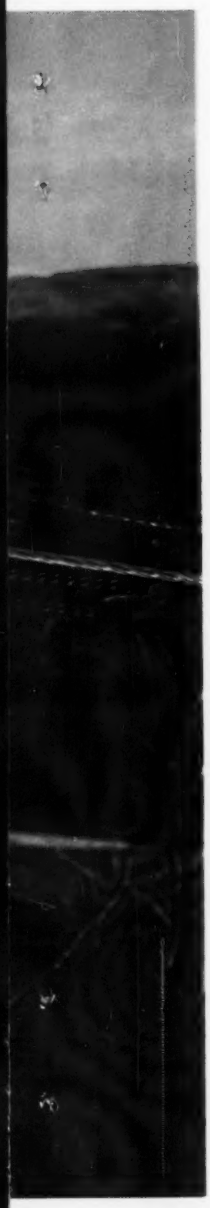
* Estimated
** First five months (estimated)

THE FASTEST, SIMPLEST, SAFEST WAY TO DEAD-END DISTRIBUTION CONDUCTORS

Philadelphia Electric Company lineman dead-ends 4/0 [redacted] conductor with PREFORMED Aluminum Dead-End. The down guy is of ⅜ galvanized steel strand with GUY-GRIP dead-end.

Patented—U. S. Patent No. 2,761,273.

With *Preformed* TRADEMARK CABLED LOOP DEAD-ENDS



which OFFER YOUR COMPANY

1. The most economical Dead-End available
2. UNIFORMITY OF ALL APPLICATIONS
3. Elimination of high stress concentrations
4. Extra holding strength to withstand ice loading and ice dropping
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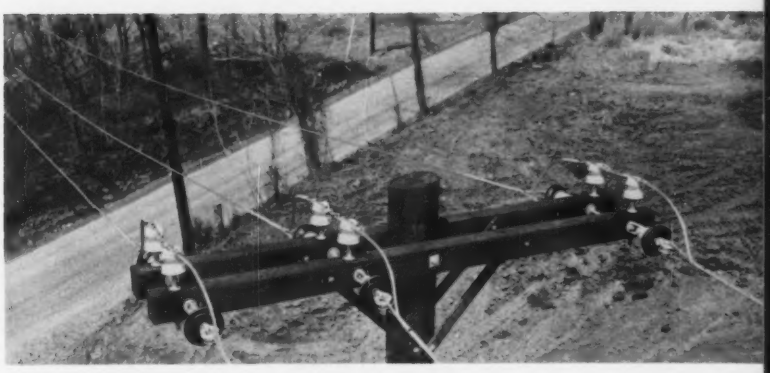

WIDE AREA SUPPORT with continuous line carry

Write for Booklet-of-the Month "Another New Twist"

PREFORMED LINE PRODUCTS COMPANY
DEPT. DE-2

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PLP® is a trademark which is registered in the U. S. Patent Office and is the property of Preformed Line Products Company.

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COMPACT... ADAPTABLE... RELIABLE

New Westinghouse Isolated Phase Bus

Ever-increasing current and voltage ratings . . . maximum in compact arrangement . . . full adaptability to generating and distribution station layouts . . . complete reliability—these are the modern station demands met by new Westinghouse isolated phase bus. Here are the design features which assure long, trouble-free performance:

Single Insulator. Only one high-strength insulator is used at each bus support location. Deep grooves provide high dew withstand voltage. Resilient mounting reduces short circuit forces on the porcelain. All combine to provide maximum reliability of service.

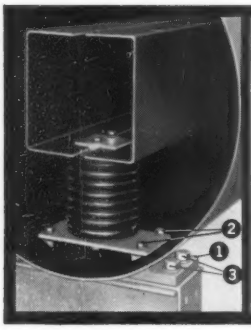
Main Conductor. Hollow square or tubular bus may be specified to suit application requirements.

Enclosure Construction. Enclosures are cylindrical; of heavy, heat-treated aluminum plate; rolled and seam-welded . . . assuring maximum strength against internal or external pressure and side stress. Enclosure tightness is assured.

Accessibility of Enclosures. Telescoping of enclosures simplifies inspection and maintenance of insulators and conductor joints. Adequate clearance facilitates telescoping and alignment. Longitudinal gaskets are eliminated. Circular, extruded, neoprene gaskets, retained by two-bolt clamping rings, make assembly easy and assure tight joints. Enclosure ends are not flanged. Small supporting feet reduce weight and provide smooth cylindrical exterior.

Coordinated Design. Westinghouse isolated phase bus is coordinated in design to assure long, economical service with minimum maintenance—and to reduce field assembly time by permitting large assembly shipments, limited only by shipping and handling facilities.

For complete facts, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-60998

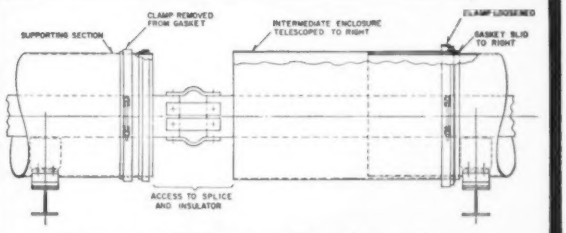


Only One Insulator Is Required at each main conductor and enclosure support location. Enclosure tightness is assured by these arrangements:

1 Welded-in support of high-strength extruded aluminum.

2 Resilient insulator mounting plate bolts dead-end in extruded support.

3 Assembly mounting bolts are external to the enclosure.



Telescoping Enclosure provides ready access to insulators and conductor joints for inspection or maintenance.

YOU CAN BE SURE... IF IT'S Westinghouse

Casey, Sealy Named Vice Presidents of CEI

Albert A. Casey and Harry T. Sealy have been named vice presidents of Cleveland Electric Illuminating Co. Casey is vp-engineering, and Sealy, vp-operations. Casey succeeded Clarence J. Beller who will retire next month.

Casey joined the company in 1920 as a test helper. He served as mechanical engineer and executive engineer before becoming general superintendent of plants in 1943. He was made manager of power production in 1952, was made a vice president in 1953, and in 1959 was appointed vice president-system operations.

In his new position he will be in charge of all the company's engineering elements.

Sealy has been with CEI since 1938. He served as superintendent of the Eastern District, and as general superintendent of services before being named manager of distribution in 1952. He was elected a vice president the following year.

CASEY SEALY

Sealy's new operations group will combine the distribution group which he now heads with the system operations group formerly headed by Casey.

Central Illinois E&G Elects Berry VP

Leaman S. Berry has been elected vice president and general manager of the Lincoln Division of Central Illinois Electric & Gas Co.

He had served since 1951 as superintendent of transmission and distribution in the company's Rockford electric department.

From 1930 to 1949 he was employed by Savannah Electric & Power Co, serving as secretary to the president, assistant sales manager, assistant line superintendent, line superintendent, and assistant superintendent of transmission and distribution.

He joined Central Illinois E&G in 1949 as assistant superintendent of transmission and distribution in 1949, and became superintendent two years later.

Stone & Webster Names Three New Vice Presidents

Stone & Webster Engineering Corp has named three new vice presidents. Theodore E. Casselman Jr becomes manager of the firm's New York office; Wilbur S. Roberts Jr, manager of new business activities; and J. Marshall Hamill, a vice president.

CASSELMAN ROBERTS HAMILL

Casselman joined the firm in 1940 as a project engineer in the Boston headquarters and was made an assistant engineering manager in 1957.

Roberts joined Stone & Webster in 1941. From 1949 through 1953 he was assigned to Great Britain to assist with the construction of petroleum refining facilities. He has headed new business activities since January, 1958.

Hamill has been with Stone & Webster since 1946 and has worked on the design of chemical and petrochemical plants in Great Britain. He is now administrative assistant to the president.

(*More News About People on page* 108)

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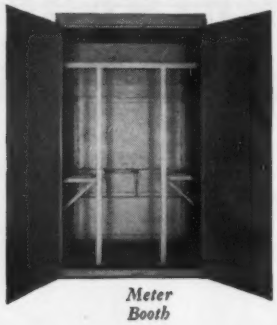
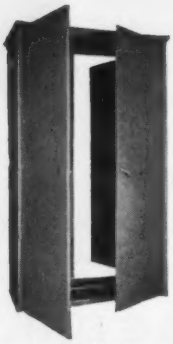

Meter
Booth

Current Transformer
Enclosure


Double Door
Enclosure

Electrical World Names New Sales Manager

Walter R. Klein, who since 1958 has handled sales contacts with major Atlantic District accounts for *Electrical World*, has been named the magazine's sales manager. He will assume his new duties September 1.

On that date, Warren Shew will relinquish the direct responsibility for advertising sales to devote full attention to his duties as *Electrical World's* publisher.

The new sales manager, who attended Columbia University, joined McGraw-Hill on Jan. 1, 1946, working at first in the production department. The following year, he transferred to the production staff of *Business Week* and in 1948 to classified advertising sales in the Atlantic District. He moved to the advertising sales staff of *Electrical West* in 1949 and to the advertising sales staff of *Power* in 1955. He has been with *Electrical World* since Sept. 1, 1958.

His replacement has not been announced.

Lloyd R. (Larry) Lawrence, on the sales staff of *Electrical World* in the Atlantic District, has been named advertising sales manager of *Product Engineering*. He had served on *Electrical World* since August, 1958, in the New England area.

His replacement in the New England territory will be Don Roberts, who has handled territorial accounts in New York City, Long Island, and northern New Jersey since Aug. 1, 1957. Roberts' new territory will include Westchester County.

The New York metropolitan sales assignment will be filled by E. Bryson (Doc) Sessions, *Electrical*

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OF QUALITY

SECONDARY
EXTENSION
BRACKET
Keeps wires clear of transformers. Complies with regulations. Sets Secondary Bracket out from pole to center of porcelain 12½". Hot dipped 2" x 3/16" x 3/16" galvanized channel.

SECONDARY CLEVIS
For use with Secondary Extension Bracket or Direct Pole mounting 4" center at hole to back of bracket. 3/16" x 3" hot dipped galvanized with or without insulator.

Transformer Adaptor Plates
For Direct Pole Mounting
Now! All type O.S. Transformers can be mounted directly to the pole with two thru bolts. Cross bar and channel function are welded all around. All hangers, kickers and adapter plates are hot dipped galvanized. Furnished complete with hot dipped galvanized bolts.

THIEL TOOL & ENGINEERING CO., INC.
1417 N. MARKET ST. LOUIS 6, MO.

World's first publication circulation manager. Sessions has been assisting with sales service and with the Mills Shepard advertising research program.

Hartzell Elected Head Of PCEA

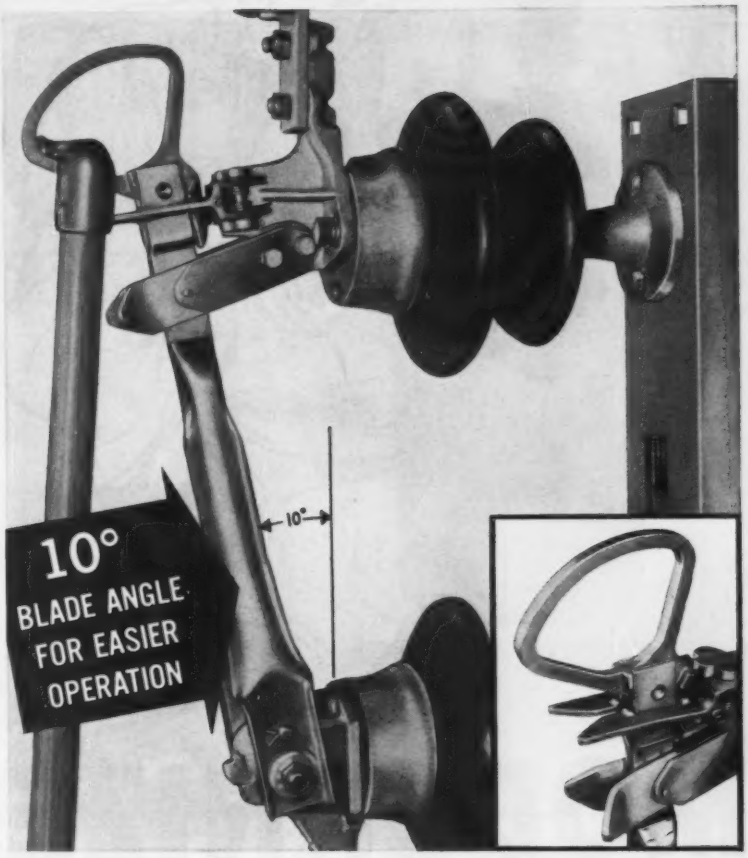
Harry F. Hartzell has been elected president of the Pacific Coast Electrical Assn. He is chairman of the board of Maydwell & Hartzell, engineering sales representatives in San Francisco.

Before the firm was organized in 1923 he was with Westinghouse Electric Corp, and Baker-Joslyn Co.

OBITUARY

Thomas G. Dignan, 61, president, general manager, and a director of Boston Edison Co . . . **William E. Mitchell,** 78, retired president of Georgia Power Co . . . **George A. Rumsey,** 89, chairman of the board of Rumsey Electric Co . . . **Edward J. Walsh,** 70, former public relations manager, Norwalk district, Connecticut Light & Power Co . . . **Carl L. Weichelt,** 90, retired experimental electrical engineer, and co-inventor of the electrical Dim-a-lit . . . **Charles A. Beatty,** 59, district commercial sales supervisor of the Appalachian Power Co . . . **Lewis E. Knifong,** 55, division substation supervisor for Idaho Power Co . . . **Ward Follet Davidson,** 69, retired research director of Consolidated Edison Co . . . **Leland Olds,** 69, a member of the Federal Power Commission from 1939 to 1949, and former chairman.

NEW Delta-Star B-2L Hook Stick Switch



The simpler, stronger design of the new Delta-Star B-2L Hook Stick Switch makes it the most reliable isolation switch on the market. New contact and hinge design minimizes current interchange surfaces, and provides lateral latching. Blade is rigid-formed hard-drawn copper tubing. Copper shoes have silver inlays for silver-to-copper contacts.

Operation of the new B-2L is easier—too. The 10° blade angle makes it easier to pull the blade—especially when the operator is directly under the switch.

Additional new features include the hook ring design, which positions the hook stick, and integral terminal clamps for ¾" IPS and 500 MCM cable, plus NEMA standard drilling for lugs.

For full information on the new Delta-Star B-2L Hook Stick Switch, which meets NEMA and AIEE standards, consult your Delta-Star representative or write to *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton St., Chicago 12, Illinois.*

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H. K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY with steel, rubber and friction products, asbestos textiles, high voltage electrical equipment, electrical wire and cable, wiring systems, motors, fans, blowers, specialty alloys, paints, refractories, tools, forgings and pipe fittings, roll formings and stampings, wire rope and strand.

MODERNIZE

With General Electric Distribution Transformer Renewal Parts

Take advantage of up-to-date distribution transformer innovations with the complete line of General Electric replacement parts. You'll be able to utilize the higher 55° ● 65° dual-kva ratings now available with a new Permalex* core and coil. You can, for instance, boost kva as much as 236 percent—from 5 to 16.8 kva in the same low-voltage tank.

Other modern General Electric features you can profitably utilize include internally-clamped high-voltage bushing, low-voltage bushing with strenicor clamps, nitrile gaskets, low voltage circuit breaker with operating handle, overload signal light and Magne-valve distribution arrester.

You can get "off-the-shelf" delivery of General Electric renewal parts—and benefit from 24-hour emergency service provided by all of the 55 G-E Apparatus Service Shops.

For more information, see your General Electric Sales Engineer or the G-E Service Shop Representative. General Electric Co., Schenectady 5, N. Y.

* Trade-mark of G.E. Co.

485-03

Progress Is Our Most Important Product

GENERAL ELECTRIC

Custom Transformers Used

(*Continued from page* 68)

vestment until just before revenue was realized from it. Several transformers and secondary compartments were installed early to furnish power for construction.

Each primary compartment contains one primary disconnect fuse for the transformer and two blade-type disconnect switches for sectionalizing. These disconnect switches are designed to interrupt full load current to 200 amp when opened with a load-break tool. They also provide visible opening of the primary. This is safety requirement of the utility.

The transformer fuse is a newly designed boric acid disconnecting type with continuous current ratings to 50 amp and interrupting ratings to 8,000 amp within this metal compartment. The fuse can also be opened under load and is replaced easily in the field. Clips on the disconnect switches allow either primary cable to be grounded without bending or moving the primary stress cones and terminations. Studs are provided in each primary compartment for mounting two 10-kv valve-type arresters. Arresters are installed, however, only at normally-open points in the primary loop and on riser poles. Primary cables terminate in the primary compartment with stress cones.

The doors of both primary and secondary compartments can be removed to gain more working space. The door of the primary compartment in the raised position serves as a walk-in barrier, and a high voltage warning sign hangs from it as an added safety precaution.

Transformers serve from three to eight residences. They are rated at 13,200/7,620-240/120 v without taps and from 37½ to 100 kva. The same tank for all sizes permits replacement with minimum time and effort and without disturbing the primary compartment and primary cable connections.

The primary transformer bushing is mounted on the side wall of the tank and is externally clamped to it. It serves as the hinge-end support for the transformer primary disconnect fuse. The transformer has a neutral and two low-voltage bushings, which project into the low-

voltage-equipment compartment.

Short buses bolted to the spade terminals of these bushings accommodate up to eight service connections. Each is fused in this compartment. Fuses are held by only two bolts, hence are replaced easily. An insulating sleeve on each end of the fuse minimizes the possibility of electrical contact between services. Time-current characteristics of the 100, 150 and 200-amp fuses permit excellent coordination with any type service entrance fuse.

Service cable from this compartment to the customer's lot line, installed by AP&L, runs in 2-in. duct. This connects to the customer's service above ground in post-type secondary terminals. Individual service for each customer directly from the transformer yields greater economy, eliminates flicker and allows the size of each service to be matched to its load. Additional duct laid along the easement will permit future installation of services without further excavation.

Dam Height Has Little Effect on Fish Mortality

Dam height has little effect on fingerling mortality for dams with heads up to 450 ft, according to a Corps of Engineering study recently completed at Tacoma City Light's Cushman Dam on the Shokomish River in Washington.

Using 40,000 fingerlings, in 48 trial tests, the Corps found survival rates varied from a low of 42% for partial power load to a high of 75% for power load of best turbine efficiency. About 89% of the fish used in the test were recovered. Mechanical injuries accounted for about 50% of the injuries. Pressure injuries at the gate opening for best turbine efficiency were comparable to those experienced in earlier tests at McNary Dam.

Cushman No. 2 plant has a 450-ft head, a 300-rpm turbine speed, and a 76-in. turbine runner dia. Fish were introduced into the penstock with a lock device at the 350-ft level and recovered from the paved tailrace. Draft tube discharge was approximately 800 cfs. The next phase of the study will determine the best turbine designs and speeds for passing fish.

By any yardstick . . .

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QUALITY

OF

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FIGURE 8

Pole & Bracket Cable

meets the test!

Measure quality any way you like, you'll find that SUPERIOR Figure 8 Pole and Bracket Cable for multiple systems is tops!

Insulated with the highest quality polyvinyl chloride, SUPERIOR'S Figure 8 Cable does not deteriorate with age or weather, will not support combustion, is not affected by common chemicals or electrolysis and maintains its high insulation resistance when wet.

More than that . . . it is tough and highly resistant to abrasion and mechanical damage, yet is flexible and strips clean which speeds installation.

Available with 10 AWG solid copper or aluminum conductors, overall diameter .20 x .396; 8 AWG stranded copper conductors, overall diameter .28 x .560; 8 AWG solid aluminum conductors, overall diameter .28 x .560. Standard reel length is 2500 feet.

For performance and economy . . . top quality SUPERIOR Figure 8 Pole and Bracket Cable is your buy for multiple systems!

For complete information and prices, write

SUPERIOR CABLE

SUPERIOR CABLE CORPORATION

Hickory, North Carolina

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3—1500 KVA G-E 69000—7200/12470Y
4—1000 KVA Mol 7200/12470Y—4160
3—1000 KVA G-E 34500-7200/12470Y
4— 500 KVA G-E 34500-7200/12470Y
6— 500 KVA G-E 34500-2400/4160Y
3— 500 KVA Penn. 13200-120/240
3— 333 KVA W-H 13200—2400/4160Y
3— 333 KVA G-E 66000—2400/4160Y
3— 333 KVA Wag. 2400—120/240
2—1500/1875 KVA Mol. 3-Ph. 40.500—4800 F/C equipped
2—1500/1875 KVA Mol. 3-Ph. 34.500—2400 F/C equipped

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47 Years' Dependable Service

SUBSTATION EQUIPMENT

TRANSFORMERS

QU.	KVA	MFR.	VOLTAGE
1	12000	G.E.	115,000—46,000 L.T.C.
1	5000	West.	115,000—13,750, 3 Ph.
1	10000	West.	67,000—34,500, 3 Ph. Auto.
1	3750	G.E.	69,300—13,200, 3 Ph.
1	3000	G.E.	69,000—4340, 3 Ph.
4	2000	Amer.	67,650—22,000
3	1250	G.E.	69,300—2400/4160
3	500	G.E.	66,000/33,000—2300/13200
1	2500	Mol.	44,000—2400/4160, 3 Ph.
2	2500	Wagner	45,800/22,900—4160Y, 3 Ph.
3	200	West.	44,000—480
1	5000	West.	34,500—13750/6875, 3 Ph.
1	4500	West.	33,000—2500/4330, 3 Ph.
2	3000	Upgf.	34,750—4160, 3 Ph.
1	2000	Kuhl.	34,650—440, 3 Ph.
2	1500	G.E.	34,400—2520, 3 Ph.
3	1250	A.C.	33,000—480
3	500	Mol.	34,500—2300/4600
3	200	A.C.	34,500—2400/7200/12470Y
2	3000	G.E.	26,400—4160Y/2400, 3 Ph.
3	1250	G.E.	29,340—2500
2	3000	G.E.	13,800—2640, 3 Ph.
1	2500	G.E.	13,800—2400, Unit Sub.
1	600	Stand.	13,200—2300, 3 Ph.
3	500	G.E.	13,200—240 x 480
1	450	Penna.	13,200—2400, 3 Ph. Askarel
3	333	G.E.	13,800—230/460
3	100	A.C.	6,900—2400
1	500	Kuhl.	4,800—480, 3 Ph.
1	1000	A.C.	2,400/4,160—240, 3 Ph.
3	400	G.E.	2,300/4,000—230/460

FEEDER REGULATORS, 3 PH.—OUTDOOR

1	750	G.E.	13,200 V. 360 A. STEP
1	500	G.E.	4,160 V. 694 A. STEP
1	375	G.E.	34,500 V. 502 A. STEP
1	300	G.E.	6,600 V. 262 A. STEP
1	250	A.C.	2,400 V. 601 A. STEP

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& CO., INC.
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ELECTRICAL ENGINEER

Subsidiary of major oil company operating in Eastern Venezuela has opening for a qualified Electrical Engineer:

Minimum Requirements:

BSEE;
plus at least three years experience in design of process plants and medium and low voltage distribution systems, application of switchgear, protective relays, telemetering and supervisory controls.

Age to 35 years.

Liberal salary—plus allowances, bonus and other benefits.

Qualified candidates submit detailed experience summary and personal data to:

P-5029, Electrical World, Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

MANUFACTURER'S REPRESENTATIVES
WANTED

Nationally known Manufacturer of Quality Line of Competitively Priced Wiring Devices seeks Agency Representation in Mid-West and Western States.

Please forward resume including territory covered, experience, references and lines now carried.

Send full details to:

RW-5063, Electrical World
Class. Adv. Div., P.O. Box 12, N.Y. 36, N.Y.

NEW UNUSED 900 KW GE GENERATOR OFFERED FOR PROMPT SALE

Owner selling one (1) new, unused 900 KW, 1125 KVA General Electric Generator, now in protected storage at South San Francisco plant. Specifications: Serial No. 6955112, .8 power factor, 360 RPM, 50° centrigrade rise, 2400/4160 volt, 3 phase, 60 cycle, 6 wire, open engine type, with damper windings, field discharge resistor, stator sole plates, stator shift and brush rigging with supports, floor mounted exciter, exciter slide rails and field rheostat. Immediate sale desired. To inspect and submit offer, contact Sales Department, Enterprise Engine & Machinery Co., P. O. Box 949, San Francisco, Calif.

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Electrical Engineer. Board layout work—power, lighting, and control systems; calculations; and occasional field contacts. Extremely wide variety of work with opportunity to enter consulting field and grow with progressive mid-western concern. P-4617, Electrical World.

Utility Engineers: E.E. and C.E. graduates with five years or more experience in utility engineering, transmission, distribution, or Substation Design, for positions in middle east. Single men or men with small families only. Prefer actual utility experience or consulting experience working with utility companies. Send complete experience and personal record to: Miner and Miner International, Inc., P. O. Box 748, Greeley, Colorado.

Generation and Transmission Cooperative in New Mexico has vacancy for graduate electrical engineer to assist with planning, installation, testing and maintenance of carrier current, supervisory control and radio communication equipment and protective relays. First class radio operators license desirable. Address experience and education record to: Plains Electric Generator and Transmission Cooperative, Inc., 2401 Aztec N.E., Albuquerque, New Mexico.

Wanted—Manager for rural electric co-op system serving 3200 members, 754 mile distribution line in north-central Indiana, must have executive ability to direct all phases of electric operations. Permanent position carrying substantial opportunity for qualified person. Replies confidential. Write for standard R.E.A. application form Fulton County Rural Electric Membership Corporation, Rochester, Indiana.

SELLING OPPORTUNITY AVAILABLE

Representative wanted for manufacturer of street lighting equipment pole line specialties. Western States. Full particulars. RW-5056, Electrical World.

WHO'S WHO in—
Electrical Equipment Representatives
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Voltage Regulator G.E. "Inductrol"
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Will accept reasonable offer, FOB Shipping Point.
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The Meetings Calendar

SEPTEMBER

Edison Electric Institute—Street and Highway Lighting Committee, Salem, Sept. 1-2; Residential Lighting Promotion Committee, Cleveland, Sept. 12-13; EEI-AGA Accounting Division & Section Organization Meetings, The Pittsburgh Hilton, Pittsburgh, Sept. 15-16; Meter & Service Committee, Westchester Country Club, Rye, N. Y., Sept. 18-21; Residential Electric Heating & Air Conditioning Committee, New York City, Sept. 19-20; Commercial Electric Space Heating & Air Conditioning Committee, Columbus, Sept. 20-21; Industrial Power & Heating Group, Milwaukee, Sept. 21-23; Residential Wiring Promotion Committee, Salem, Mass., Sept. 22-23; Farm Group Meeting, New York City, Sept. 26-27; Commercial Lighting Committee, Birmingham, Sept. 26-27; Residential Appliance Promotion Committee, New York City, Sept. 26-27; Industrial Relations Committee, 13th Annual Round Table Conference, Drake Hotel, Chicago, Sept. 26-28; Market Research Committee, Detroit, Sept. 27-28; Home Service Committee, Forth Worth, Sept. 29-30.

Southeastern Electric Exchange — Personnel Administration Section, Roanoke Hotel, Roanoke, Sept. 1-2; Accounting Conference, Tides Hotel, St. Petersburg, Sept. 29-30.

Association of Illinois Electric Cooperatives—Annual Meeting, St. Nicholas Hotel, Springfield, Sept. 7-9.

Northwest Electric Light & Power Association—53rd Annual Meeting, Glacier Park Lodge, Glacier, Mont., Sept. 7-9.

Joint Automatic Control Conference—Sponsored by ISA, ASME, AIEE, IRE, AIChE, Massachusetts Institute of Technology, Cambridge, Mass., Sept. 7-9.

Rocky Mountain Electrical League—Annual Fall Conference, Hilton Hotel, Denver, Sept. 7-10.

American Society of Mechanical Engineers—International Air Pollution Congress, Statler-Hilton Hotel, New York City, Sept. 10-11.

Electrical Living Show—New York Coliseum, New York City, Sept. 10-18.

Illuminating Engineering Society — 1960 National Technical Conference, Penn Sheraton Hotel, Pittsburgh, Sept. 11-16.

Northwest Public Power Association—Accounting Section, Annual Meeting, Wenatchee, Wash., Sept. 14-15; Power Use Section, Annual Meeting, Hotel Monticello, Longview, Wash., Sept. 29-30.

Public Utilities Advertising Association—Region 5, Annual Meeting, Tampa Terrace Hotel, Tampa, Sept. 15-16.

Public Utilities Association of the Virginias—Executive Committee, White Sulphur Springs, W. Va., Sept. 15; 42nd Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 15-17.

Municipal Electric Utilities Association of New York State—30th Annual Conference, Lake Placid Club, Sept. 15-17.

Pennsylvania Electric Association — Annual Meeting, Penn Sheraton Hotel, Pittsburgh, Sept. 21-22.

Industrial Electronics Symposium—Manger Hotel, Cleveland, Sept. 21-22.

Inter-Industry Farm Electric Utilization Council—7th Annual National Electric Farm Power Conference, Kentucky Hotel, Louisville, Sept. 21-23.

National Power Conference—Sponsored by American Institute of Electrical Engineers and American Society of Mechanical Engineers, Bellevue-Strafford Hotel, Philadelphia, Sept. 21-23.

Missouri Valley Electric Association—Accounting Conference, President Hotel, Kansas City, Sept. 22-23.

• Additions this week.

Electrical World's Second Street and Highway Lighting Conference — Hotels Ambassador, Chicago, Ill., Oct. 19-20.

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